ELECTRICAL REVIEW

[ILLUSTRATED.]

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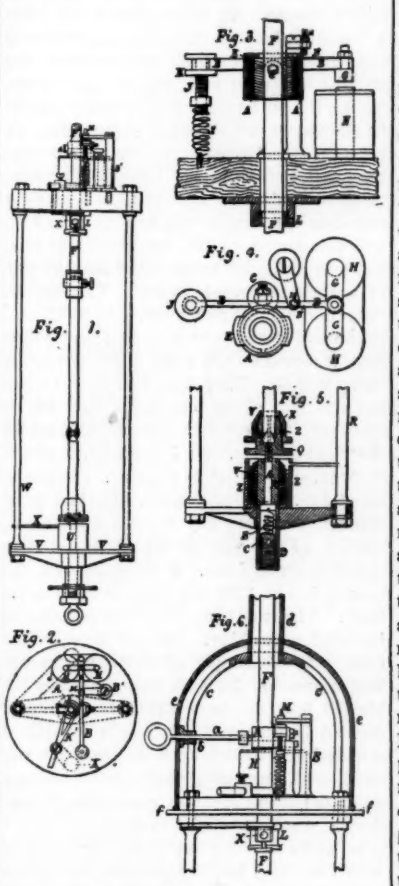
The Belfast Arc Lamp.

The Belfast arc lamp was invented by Mr. Newton, electrician to the Belfast Electric Appliances Company, and is distinguished by the great simplicity of its feed, which pushes the carbon forward by minute installments following each other in rapid succession. As this is the most interesting feature of the arrangement, we will describe it first, premising that the feed magnet is worked by a shunt current, the arc being established by a second magnet in the main circuit operating on the lower carbon. *A* (Figs. 1, 3, 4 and 6) is a hollow cylinder of brass, split down one side, to enable its diameter to be slightly varied, and attached at the opposite side to the arm *B*, which can rock about the central pivot *C*. Within the cylinder *A* is a lining of card filleting made of hard steel wire fixed in a stout leather backing, as shown in section in Fig. 3. The points of the wires inclose a smaller circle than that represented by the carbon holder, and therefore, when the holder *F* is pushed into the cylinder, the wires exercise an electric grip upon it. One end of the bar *B* carries an iron armature *G* at a short distance from the poles of the electro magnet *H H* (Fig. 4), whose coils form a shunt to the arc; the other end of *B* is attached to the tension spring *I* by the adjusting screw *J*. *M* (Figs. 2, 4 and 6) is a platinum-pointed contact screw, which, by making contact with the small spring *N*, completes the circuit through the coils of the electro-magnet *H H*. The action of the device is as follows: As long as the length of the arc remains normal the attraction of *H* upon the armature *G* is not sufficient to overcome the force of the spring *I*; when, however, the arc exceeds its normal length, the shunt current is increased, and the magnet *H* draws down the armature *G* until the contact at *M N* is broken, when the spring at once draws *G* sharply up again to its former position; the making and breaking of the shunt circuit thus establishing a sharp vibration of the bar *B* and attached clip. Now, the effect of this rocking motion of the arm *B* is to cause the opposite sides of the clip *A* to rise and fall in sharp alternation, while, owing to the downward inclination of the elastic fibers or wires lining the clip, each side, in descending, grips the rod *F* firmly and brings it down with it, while the opposite side, in rising, slips freely up the rod for a fresh grip. Thus the rod is carried steadily forward by the motion of the lever *B* in either direction, each stroke advancing the carbon by about $\frac{1}{100}$ in., or even less; in fact, the lamp may be adjusted so that the feed is imperceptible and absolutely continuous. The length of the arc may be varied within very wide limits by tightening or slackening the screw *J*. The greater the tension of the spring *I*, the longer will the shunt magnet be in coming into action, and the wider the arc maintained. The main current enters the lamp at *X*, passing through the split wire brush *K* to the positive carbon holder *F*, thence through the carbons and arc to the electro-magnet *V*, through the connection *X* to the rod *W*, which is insulated from the bridge *V* to the negative terminal. A very small portion of the current is shunted past the arc to actuate the feed of the lamp, and passes from the rod *F* through the feeding arrangement *A* to the bar *B*, and thence to the pillar B^1 by the contact at *M N*, seen more clearly in Figs. 3 and 4. From B^1 it passes round the electro-magnet *H H*, and thence to the negative terminal. From the above it will be seen the "Belfast" lamp possesses many features of great novelty, and is distinguished by extreme simplicity of design and action. The working parts are very few, with a noteworthy absence of any gearing or clockwork, and therefore should not easily be clogged or get out of order. It will work in any position, and, indeed, may be turned upside down without in the least interfering with its action. This feature should make it particularly valuable for ships or railway trains. —*London Engineering.*



NEWTON'S ARC LAMPS.

The Dangers of High Tension Currents.

M. Hospitalier writes the following in *L'Electricien*: "The use of currents of high tension offers, as is more or less admitted by everyone, obstacles and dangers which delay their industrial application. Alluding, at present, to the dangers only, we think it right to remind our readers that they appear to be admitted as real even by the most pronounced advocates of the high tension currents. In October, 1883, M. Joseph Bertrand, perpetual secretary of the Academy of Sciences, wrote in the *Revue des deux Mondes*, as follows: 'In a large machine everything, even the danger which we must face, is large; the dangers are foreseen, we must know how to neutralize them. Let the E. M. F. be 7,500 volts, it will be certain death to whoever touches the conductors; everyone must be warned. Is it safer to live amongst mechanical wheelwork?' . . . It is quite natural that we have sought to eliminate those dangers, and, whilst we are awaiting the publication of the proceedings of M. Marcel Deprez, Dr. d'Arsonval has, in a note read before the *Academie des Sciences*, at its meetings of the 26th of January, 1885, indicated from his point of view, in what manner the problem may be solved. M. d'Arsonval states that, in general, the accidents which have occurred up to the present time did not take place whilst the electric current had a permanent existence, but at the moment of the breaking or of the making of the circuit. That is a statement which does not appear to be borne out by facts. As a case in point, we cite the fatal accident which occurred recently in England at the Health Exhibition with a high tension Hochhausen machine *without interrupting the circuit*. It is, then, a perfectly established fact that a great difference of *permanent* potential, that is to say, such as not to be perceptibly lowered by the discharge through the human body, is capable of causing death. This does not in any way affect the exactness of the propositions laid down by M. d'Arsonval in the note quoted above, but we wish to show clearly that those propositions do not apply to the current whilst actually flowing, but to the moment of its interruption. The self-induction of a circuit setting up, at the moment of the interruption of the current, an E. M. F. of self-induction of short duration, and of far higher tension than the initial E. M. F. which maintained the current, any arrangement capable of absorbing or diminishing that E. M. F. will undoubtedly lessen the danger, and we are glad to admit that the shunt-voltameters may be capable of neutralizing the effect of the extra current. But this result, whose usefulness and importance we are pleased to recognize, does not in the least diminish the danger of the contact by the human body between two points of a circuit whose difference of potential is great. It will therefore be useful to seek to determine experimentally the limits beyond which the tension would become dangerous in practice; the subject is not, however, adapted for direct experiment, and if we can succeed in determining those limits, it will be judicious to apply the means recommended by M. d'Arsonval for preventing the extra current, set up by the interruption of the circuit, from exceeding them."

The Distribution of Electricity.

The first of a series of three lectures on this subject was delivered on February 6th, in London, at the rooms of the Society of Arts, John street, Adelphi, by Professor George Forbes, M. A., F. R. S. E. There was a large attendance, and great interest was manifested in the lecture, Mr. Forbes' remarks being several times cheered.

Professor Forbes said that when he was first asked to give this course of lectures on the "Distribution of Electricity," he thought it would be an interesting thing in a general and somewhat popular manner to give a description of the different schemes which had been proposed for lighting large installations and central station lighting, and to simply treat what had already been written in a general sort of manner. But as soon as he began to go into the questions at all, he felt it would be losing an opportunity for doing something which would be far more useful, and that was to talk on the subject from a more technical point of view than that which he had originally thought of, and to discuss somewhat fully these different systems and explain the defects of each, and what were the relative merits of them, and really go into the question in a more thorough manner than anyone had found it worth his while up to the present time to attempt in these different problems. That, then, was the scheme he had before him in the course of those lectures. They all knew the different systems that had been proposed for lighting; they knew how the arc lights had been distributed in series, and how incandescent lamps had been put up, the multiple arc lamp on large stations, and more especially they were aware of what had been done in America. A great many eminent engineers had, doubtless, attacked the problem from the very beginning; but very few had written or published anything on the subject. It might be that, having expended a large amount of time in research, they were glad enough to remain possessors of the knowledge they had gained. In some cases only a special system had been marked out, and in very few cases had all the systems been relatively compared and pursued so as to bring out the most economical systems possible. Besides these two systems —the series system and the multiple arc system—they were aware that the latter was subdivided into a large number of different ways of distribution. They had all heard of the network system—a system with mains and lines of centers of distribution. So they had another one, which was called a multiple series system, which had been used to a certain extent very successfully, but which had some radical defect in it which had prevented its general adoption. At the same time it must be said that many distinguished engineers believed that in the future there might be a possibility of rendering this multiple series system efficacious, and of removing the difficulties which were in the way. The objection to the ordinary multiple system—where all the lamps were connected on to massive mains, or a number of massive mains which were so connected as to make two massive mains—the objection to that system was the enormous cost of conductors. During the past few months there had been several committees started with a view of influencing the Board of Trade to take action in removing some of the restrictions in the Electric Lighting Act of 1882, which had proved such a hindrance to the progress of electric lighting. But besides that difficulty there was the fact that the Electric Lighting Act was simply unworkable, as every unprejudiced person must admit. There was another fact which had largely hindered electric lighting, and that was the enormous cost of mains. Not only that, but the multiple arc system introduced another serious expense. It became essential with such large mains to have rather a central station, with the engine in the center of the

district which was being supplied. In thickly populated districts, such as would be necessary in manufacturing the light on the multiple arc system, it was very difficult to get a site for the engine and dynamos, and it had been acknowledged by those who had undertaken to work the system in London to be one of the serious objections to the multiple arc system. It was of the utmost importance that engineers should devote their energies to the most economical system possible, whether that system be the multiple arc or the multiple series, or any of the modifications which had been proposed. At the present moment there were thousands of people in the city who were anxiously waiting to have the electric light supplied to their houses, but they were prevented from having it—partly on account of the fact of the expense in the outlay, and partly by the gas monopolists and the assistance which the gas monopolists had received from the Electric Lighting Act of 1882. That would not much longer be maintained, he thought they could safely trust, and in that case they must be prepared as engineers with most economical means of laying down thick mains, so as to make electric lighting then a possibility in an economical and financial way. The question of the production of electricity was one on which he need say but little At the present time electricity was produced by dynamo-machines, and that was by far the cheapest way, and there was no immediate prospect of any other system being introduced which was more economical. The question of primary batteries might be completely laid aside. There was no prospect that any primary battery would be rendered an economical means of producing electricity. It was true if it was possible to consume carbon in the form of coal or charcoal by oxidization, instead of consuming zinc, they might have some economical battery which might compete with the dynamo. In 1880 he (Mr. Forbes) was engaged in making a number of experiments in that direction, but owing to an unfortunate circumstance they were discontinued; but many people had taken up the subject, and every now and then they heard prospects of something being done; but at the present moment they were very far from it, and before such a thing was done they would require something that would be entitled to rank as a real and original discovery—a discovery which did not come to them at the bidding, a discovery which was more often made in the laboratory of the patient investigator rather than in the workshop of the speculative inventor.

Secondary batteries which were being supplied with their charge from dynamos might be looked upon as a means of supply rather than as a means of production of electricity. The same might be said of secondary generators, which had attracted considerable attention during the last year or two. He would now come to the problem before them—namely, the problem of the distribution and supply of electricity—but before attacking the problem directly he would take a general survey of the comparisons between electricity and gas in that respect. The production of gas was a far more complicated operation than the production of electricity. It was a somewhat complicated mechanical laboratory experiment produced on a large manufacturing industrial scale; but the distillation of the gas from the coal, and subsequent treatment by scrubbers, condensers, and lime purifiers previous to its introduction through a meter into the gas-holder and its supply to the service pipe, was a far more difficult operation than the similar problem in the case of electricity. When, however, they came to supply, the gas and electricity problems resembled each other a great deal. Gas must be supplied in pipes at a certain pressure, the size of the pipes must be regulated by the quantity of gas that was to pass through them, and the quantity of gas flowing through them must be so regulated that the pressure at the point of supply—namely, the burners—must not vary to any great extent. In all these points they had an analogue to gas in electricity. He should use the word "pressure" in speaking of electricity because it was used as a Parliamentary term, and it was a very convenient, and really, he believed, a scientific term—a pressure on any point to indicate the difference of potential between the conductors at that point. There were two points in which gas differed very materially from electricity. One was, if they took 100 wires of a certain diameter and passed the current of electricity through them, and then passed the current of electricity through the same mass of copper grouped into one wire, the resistance offered by the conductors was the same. If, however, they passed gas through 100 small pipes, and then passed the same quantity through one large pipe which had the same area, there was far more resistance in the case of 100 pipes than in the case of one pipe. The other point of difference consisted in this, that gas pipes were hollow, and it was simply space that was filled with illuminating material. In the case of electricity the mains were solid, and the illuminating electricity passed through the solid material. The consequence was that whereas in gas the cost of the main was not in proportion to the quantity of gas, in electricity it was certainly in proportion to the quantity of electricity which had to pass through them. That was why when they came to an electric main they had such an expensive system to deal with. As to the introduction of electricity, it astonished one to think how serious had been the obstacles to the introduction of electricity compared with those in the case of gas, although the dangerous, unhealthy qualities which accompanied gas in its inception were absent in the case of electricity. It was the object of the electrician to diminish the cost of the mains, and whenever they found that by diminishing the cost of the mains they were introducing new engineering difficulties that was a problem for the engineer to overcome, and he must overcome it if it was to be overcome rather than increase the cost of his mains. There were three reasons why it was objectionable to diminish the size of the mains. The first was the waste in energy which was used up by the resistance of those mains. They had to supply so much extra power in their central stations in order to waste it simply upon heating up these mains, and that meant the annual expenditure of a certain sum of money; whereas if they had made the mains a little thicker they would not be wasting so much energy, and, therefore, by the primary outlay of a certain sum of money they would be saving an annual expenditure. The question was to balance these two matters in such a way that they arrived at the most economical result.

Mr. Forbes then made some calculations, the result of which, he said, was that, as to horse-power, there was equal to 3.2 horse-power used up in every 100 yards of 1 in. conductors for every 1,000 amperes. As to the cost, he would take £20 as the cost of horse-power. That would show that £64 a year was being wasted in every 100 yards of conductors, and at 5 per cent. that means a capital of £1,280. If he doubled the size of the conductor he halved the quantity of power which was being wasted and reduced in to £640. Then came the question whether it would cost more than £640 of capital to lay down that 100 yards of extra inch section. No, it would not cost that; therefore it would be economical to increase the section of conductor up to 2 in.; so they went on until they found that the gain, owing to the diminished waste in conductors, was just equal to the extra expenditure of capital in laying down the conductors, and then they arrived at a satisfactory arrangement. In the case referred to, the conductor came out about 5 square inches to the 1,000 amperes as the most economical condition, that was on the assumption of the laying of the extra thickness of copper being at the rate of £10 a ton. That was for the engineer to decide as to what he considered right. That was a very important point. In fact, it was one of primary importance, and one which must be dealt with by every electrician in every case he was dealing with. He must estimate carefully what would be the cost of laying down thicker conductors, and what would be the gain in the amount of energy. A question that became a trouble to them was, what were they to consider the cost of electrical horse-power? That, of course, depended upon the number of hours it was used. For 1,000 hours in the year the cost would be about 5d. an hour; for 2,000 hours 3.5d. an hour. About 1,000 hours was a fair consumption for a town; but for present purposes he would put it at 1,500 hours, and that would give an average cost of almost exactly £25 a year. If they worked out the cost of the energy wasted in 100 yards of conductor, it would be found that the following figures represented the energy wasted: For 3½ in., £22.8; for 4 in., £20; for 4½ in., £17.8; for 5 in, £16; for 2½ in., £14.5; for 6 in., £13.2; and for 6½ in., £12. Those were the gains there were in the different sized conductors. Next they had to decide as to what was the interest upon the capital expended. That depended upon the way in which the mains were laid, and different people had different ideas as to the way in which they should be laid. He could not see the object of using stranded cables, as that was the most expensive form in which they could produce their copper, and nothing was to be gained by it. It seemed to have arisen from the use of cables for the submarine work, but that was a different kind of thing altogether as regards the strain. Other people thought it should be a flat sheet laid in troughs. He had reckoned that £100 a ton was the cost of adding an additional mass of copper to their mains after the troughs had been laid, and it was for the engineer to determine what interest should be allowed on that—whether 5 per cent., 7½ per cent., or 10 per cent. As the size was increased, the percentage allowed for maintenance should be diminished, because wear and tear was much less, heating was less, and the danger to the insulation was less, and everything led to the belief that the cost of maintenance would be less. That was an important point to remember. At 5 per cent. the annual cost would be 1.27; at 7½ per cent. it would be 1.91; and at 10 per cent. it came to 2.55. They had, therefore, to find out the size of the conductor that would equal the interest that one might consider the right interest. At 5 per cent. it would be 3½ in. ampere; at 7½ per cent. it would be about 4 in. or 4½ in. ampere. He had gone through that carefully to give a clear conception of the way in which the problem was to be worked out. It might be said the assumption of £250 to a horse-power was too large. That was true, but in the estimate he included everything. But all these points came into the supply of electricity, and it was a question for each one to consider for himself how far those expenses were to be divided in that way. It might be said it was desirable to look upon the plant as being fixed, and, supposing they wished to carry an extra current over the same size of conductor, would it be wise to do so?

In order to carry an extra current they would say they had to put down extra steam engines for the dynamo power. It might cost ¾d. per hour, or, when transformed into electrical horse-power by means of a dynamo, it might cost 1d. an hour. Working for 1,500 hours that would come to £6.250. Then they had to add to that the cost of the dynamo, which might be taken at £10 to the 1,000 watts of maximum output, and that gave an annual expenditure of £1.125. The result was the total annual expenditure would be £7 375 cost of horse-power. That being worked out at 7½ per cent. as the cost of copper conductors, would come out most favorably, and the dimensions would be 3 sq. in. to the 1,000 amperes. He had simply given those two or three examples in order that they might thoroughly understand the general principle and the way it was worked out. No considerations must ever allow the engineer to deviate from the strict rules which regulated the cost. It was of no use for an engineer to say that financial people would not bring forward the money for costly mains. He must honestly tell them which was the most economical way of doing it. If the financier wished to raise capital by showing small capital outlay, knowing all the time he was going to waste far more money by his annual expenditure and waste of energy, that was his concern; the engineer ought to have nothing to do with such matters. The second reason why they must not diminish the thickness of their conductors too much was that it would heat them too much, and it spoiled the insulation, and the material itself became injured The conductors were injured because their resistance was increased by the increase of temperature. As to underground conductors, if they did not bury the conductors more than 2 ft. the temperature of the surface was not affected; but if they were put deeper than 2 ft., the surface temperature would be affected. The third reason why they could not diminish the conductors too much was because the fall of the potential would be so great; and one very important point to consider, and which he thought had often been overlooked, was that 1,000 amperes was the average current, and not the maximum current which passed through the conductor.

At the Philadelphia Exhibition there was a Board of Examiners especially appointed to examine the underground conductors, but no good came of it, as they were afraid to give any opinion in favor of one system as against another. There were many systems, such as troughs, glass, stone, etc., for carrying the underground conductors. The Jablochkoff Company, since 1878, had used on the Thames Embankment a 16-strand wire, insulated with gutta-percha and tape, placed in troughs, and it had given very little trouble.

Mr. Forbes concluded by saying that this lecture was simply to prepare the way for the questions of the different systems of line conductors, and in the succeeding lectures they would see how the engineers had attempted to get over the problem of the fall of potential, and how to combine economy with efficient working.

NEW YORK, March 13, 1885.

Editors Electrical Review:

In your issue of February 28 you publish a criticism by a gentleman from Detroit, Mich., upon certain quotations which substantially declare electricity to be a substance.

I beg leave to uphold the theory decried by the learned critic, and, in order to get a little closer understanding of the theory than is indicated in the reference quoted by him, I will propose the following definition of electricity, which, although I am not prepared to say is strictly true and correct, I am prepared to say that it is the most complete and simple theory of explaining all known electrical phenomena; and that, instead of its being "a stumbling block that impedes progress and trips every scientific explorer in the domain of electricity," it is the morning breeze which fans away the fogs and mists that have up to the present time mystified and bewildered the scientist and the artisan:

"Electricity is a substance pervading all other substances, extremely elastic, its particles repelling each other at a distance as well as when in contact; attracted by and attracting all other substances in different degrees; flowing between the particles of all other substances with greater or less degrees of freedom, but in no case without friction."

"Thousands of times," says your correspondent, "and in every conceivable way, it has by experiment been verified that light, when it disappears, is converted into heat; that when heat disappears it is converted into electricity, and that when electricity disappears it is reconverted into heat and light."

Let us analyze a simple and common experiment with which everybody is familiar, and see whether this is true or not. Take, for instance, an ordinary electric light circuit, with its exciting machine, its conductors and its lamps; whether they be arc or incandescent is immaterial. The exciting machine requires a certain amount of force to keep it in motion; the current flows out from the positive pole, does its work in the lamps, and

flows back by the negative pole. I put my measuring instrument into the circuit at the positive pole and again at the negative pole, and I find the current at both places to be exactly the same, and that not one particle of electricity is lost in the lamps. Force has been expended in the exciting machine, and consumed by friction in the lamps. The result is light and heat, but no electricity has disappeared, for we find it all returning to where it started from.

An analogous case is a pump forcing water through pipes and turbine wheels. Force is expended in the pump to move the water, and that same force is recovered in the turbine wheels, except what is lost in friction, but the water is all there, and it is water still.

Again, we take a Leyden jar, with an insulated inner coating, and charge it to a high tension from a Holtz machine. Now we bring up near to the charged jar the projection from the inner coating of another jar; a spark passes, producing light, heat and noise. But the two jars, if they be examined after the discharge, will be found to contain just as much electricity as the first jar originally contained, except what may have escaped by imperfect insulation during the experiment.

A certain force was expended to charge the first jar up to the high tension required; part of that force has now been converted into heat, light and sound; the result is that the charge is diffused over a larger surface under a lower tension, which tension would have required less force primarily to produce, but the electricity is all there, and is electricity still.

The analogous case is forcing water into a stand-pipe until a high pressure is attained; then, by a cross-pipe at the bottom, allowing a passage for the water into another pipe.

The pressure in the two pipes at the finish will be half what it was in the first pipe, provided the pipes are the same size, and in reducing the pressure a certain portion of the original force expended has been recovered in the shape of work in the cross-pipe, but the water is all there.

Your correspondent continues: "Now, according to the quotations, the atoms of this sublimated matter attract gross matter. How wonderful! These atoms freely move through solids, and, permeating space, act upon solid matter, pull it hither and thither, which pull causes its ponderosity. They make matter go to them instead of their going to matter, which, from their having no ponderosity, and therefore capable of offering resistance, we would infer they would naturally and inevitably do"

All facts and phenomena which we do not understand seem "wonderful," but when we comprehend them fully they appear simple, and we say, "How stupid we are."

The two pith balls upon the prime conductor of a statical electric machine stand out from each other when charged, and drop together when discharged. What more evidence does your correspondent want that the particles of the overcharge of electricity, confined by the insulating surroundings within the pith balls "pull them hither and thither" by the power of their repulsion of each other, and their attraction for the particles of the pith balls.

Thousands of experiments might be cited, all proving or tending to prove the same thing, without one contradicting fact.

Your correspondent further, granting that electricity is a substance, assumes that it has no ponderosity. This, again, I deny. True, its ponderosity is very slight, indeed, but it is only a question of degree. Metallic mercury has more ponderosity than water; water has more ponderosity than air; air has more ponderosity than electricity. The fact that time is required to move electricity from one point to another tends to prove this point, and numerous other experiments might be cited if time and space would permit.

Newton discovered the law of gravitation by watching an apple fall from a tree on a still day, and wondering how it happened to come towards the earth instead of going off into space. Did your correspondent ever watch a thunderbolt strike the earth, and wonder why it didn't shoot off into space instead of taking the direction of the earth? If the earth attracts one, it attracts the other. He may choose to regard an electric discharge from the clouds as an abstract force, but I choose to regard it as a concrete substance impelled by a force, and that force is the attraction of the earth and the mutual repulsion of its own particles in the overcharged cloud.

The only satisfactory theory which I have been able to sift from all the copious discussion upon this subject is briefly this: In the composition of the earth there is a certain amount of electricity—the same as there is a certain amount of water or air. The attraction which all other substances has for it and the repulsion of its own particles, together with its capability of flowing through other substances, would naturally cause it to be distributed through all other substances in proportion to the degree of attraction which each individual substance has for it. This condition may be called one of saturation or equilibrium, and all electrical phenomenon, of whatever name or sort, are caused directly and only by a disturbance of this equilibrium, and made manifest to us in the electricity, itself restoring or seeking to restore equilibrium.

Yours truly,

LUCIUS J. PHELPS.

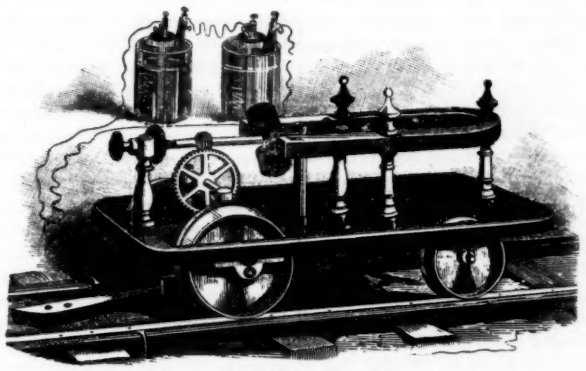


FIG. 1.—ELECTRO-MAGNETIC LOCOMOTIVE.

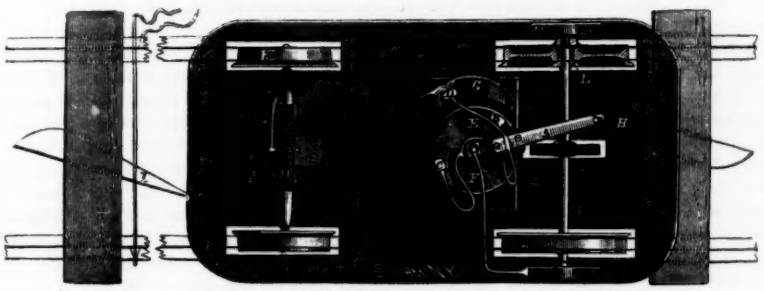


FIG. 2.—INVERTED PLAN VIEW OF ELECTRIC LOCOMOTIVE.

An Early Electro-Magnetic Locomotive.

In the interesting account of electromotors contained in a letter of Prof. Moses G. Farmer to C. W. Field, there is a description of a small electro-magnetic locomotive, constructed in 1851 by Thomas Hall, of Boston, and which operated by an electric current conveyed by the rails, probably the first instance of an electro-locomotor deriving its actuating current from a stationary electric generator. This engine, with a part of its track, is represented in the accompanying cuts; it is owned by E. Dwight Kendall, consulting chemist, of Brooklyn, who purchased it, soon after it was made, of Daniel Davis, Mr. Hall's former employer. Prof. Kendall, who was at that time, as now, a valued contributor to the *Scientific American*, occasionally used it in his lectures to illustrate electro-magnetic force.

The current of a battery or small dynamo electric machine is conveyed to the rails, the connections being made as shown in Fig. 1. The rear axle, *M* (Fig. 2 being an inverted plan view of the locomotive), consists of a central wooden portion which is slotted to receive a standard projecting from a brass plate screwed to the bottom of the car. A bar connects the pivot pin with the shaft carrying the wheel, *K*, which takes up the current from the rail; the other wheel, being insulated by the wooden portion, has no effect upon the current using the rail it runs upon. Both these wheels are loosely mounted. The current is led from the wheel, *K*, through pivot, brass standard, and wire, to brass plate, *G*. The front wheels are rigidly mounted upon an axle, at the center of which is secured a gear wheel. One wheel is insulated from the axle by means of an ivory sleeve, *L*. The current passes from the rail through the wheel, *J*, through the axle bearing and wire to a standard provided with a collar formed with an arm to which the lever, *A*, is fastened. This lever is insulated from the collar arm by a block of wood. Soldered to the rear end of the lever is a wire, one section, *D*, being always in contact with the plate, *G*, and the other section, *B*, being turned and passed under the lever so as to rest in contact with plate, *E*, which is one of a pair on the bottom of the car at each side of the standard. A wire, *C*, from the collar is in contact with plate, *F*. By means of the lever the pieces, *B* and *C*, can be brought in contact with either of the plates, *E* and *F*. From the free end of the lever a short bar projects downward, so as to be struck and moved to one side or the other by the blocks, *H I*, which are placed, one at each end of the track, at such an inclination as to move the lever sufficiently to change the plates with which the points, *B* and *C*, come in contact.

Mounted longitudinally upon the top of the platform is a shaft carrying an electro-magnet, revolving between the poles of a horseshoe magnet, and a worm which meshes with a gear wheel engaging with the wheel on the forward axle. The wires from the magnet lead to two semi-cylindrical pieces at the rear end of the shaft, against which press two springs connected respectively with the plates, *E* and *F*. The path the current travels, when the lever is in either of its two positions, to revolve the magnet first in one direction, then in the other, will be understood from what we have said and from the engravings. With the current from two or three Grove or chromic acid cells, the little locomotive exhibits great earnestness of purpose, and runs with respectable speed.—*Scientific American.*

Should it be decided to hold the next electric light convention in this city, the display of electric light appliances, incandescent and arc, and the opportunities that would be given delegates to see the workshops and laboratories of the East, would be of incalculable value to all those interested in the advancement of electric lighting.

The Callender Insulating and Waterproofing Company.

I had the good fortune, a few days ago, to find myself in Newark, with a permit in my pocket admitting me to the works of the Callender Waterproofing and Insulating Company. I was shown with great courtesy through the factory by Mr. W. M. Callender. The works are commodious, built to answer the universal demand for a good, cheap insulator, and with an assurance that they had discovered it, an assumption which facts seem to bear out. While there I saw them insulating a large cable of twenty-five strands of No. 2 B. G. copper wire. This has been ordered for a plant in Mexico. The base of the insulator used by the Callender Company is bitumen. The only bitumen which is entirely suitable to this purpose is a kind mined in one of the West India Islands; this bitumen is remarkably pure, and has not a trace of that great enemy of exposed insulators—sulphur. The lump bitumen is sorted, and afterwards boiled and vulcanized, other ingredients being added to increase its toughness and its power of resisting the oxidizing effect when buried.

The vulcanized mixture is put into a machine called a masticator. I have a sympathy for this machine, for I chewed on a piece of bitumen for three hours without the slightest effect, except a tired jaw. When taken out of the machine it is in the form of a plastic elastic sheet. This is then fed to the machine which coats the wires, the wire itself being fed through a central orifice, and being coated as it advances by the insulator supplied to it through a concentric orifice. The insulated wire from this machine is next passed through troughs of water whose temperature is graduated from the temperature of the insulator as it is put on the wire to the temperature of the air; this process is found to give a greater elasticity to the insulator. This is then braided, coated again with the insulator, and braided a second time. For submarine work, in addition to all this, the cable is heavily armored with steel wire.

I was shown into the electrical testing room where all the wire is tested before shipment. The instruments are of the kind that delight an electrician's heart; as to their accuracy it is sufficient to say that by their means a fault can be located in the cables within six inches. The cables are immersed into a large tank of water and tested for insulation as submarine cables are, by the charge and discharge method. This insulator has had a protracted severe and practical test in England, and has been adopted by the Postal Department there. H.

Accumulation of Idle Funds.

The accumulation of idle funds in New York and at other money centers is beginning to attract much attention. Several private bankers have requested their depositors to withdraw their deposits, finding it difficult to place the funds in their hands at rates sufficiently remunerative to pay the cost of carrying on the business, and experiencing no difficulty at getting all the money they want at very low rates. This accumulation of idle money is the natural result of want of confidence, and is a sufficient answer to the question so often asked, What has become of all the money? But the longer and more rapidly this process of aggregation goes on, the nearer do we approach the time when business men, tired of having no returns on their capital, will venture something, and thus give an impetus to trade. It is true that confidence is a plant of slow growth, but it is also true that its rate of growth increases as the process goes on, and that towards the last it ripens very fast indeed. All signs point to the fact that capital is already becoming tired of reaction and will soon take a start. When it does it will seek those investments which give the greatest promise of speedy returns, and among these there are many of an electrical nature which will claim attention.

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Again the long-looked for and very much desired constant primary battery has been discovered, but of course all access to it is refused, and the story of its wonderful doings come only second-hand. This time the statement is that after being kept short circuited for *one hundred and twenty days* it showed no appreciable diminution in power, the only addition made in the interim being pure water to make up for evaporation. As a matter of course we have not seen the battery, but we have, as in many previous cases, seen persons who have seen it and claim to know all about it. We have no disposition to ridicule or deny that of which we have had no opportunity to inform ourselves, and therefore remain in an attitude of neutrality and expectancy. But we would advise the parties in interest to let as little grass grow under their feet as possible. If they have what they so confidently claim they have it has a value the daily interest on which is well worth looking after. To them time is money in a double sense, and they ought to work nights if not Sundays to get their papers out and bring this marvelous battery before an anxious, impatient and expectant public. We may add that it is in Boston that this truly wonderful battery has been produced and these astounding results attained. We shall keep our ear to the ground, and see to it that our readers are informed concerning the alleged powers of this astounding battery at the earliest moment possible.

The move on the part of certain persons to get the legislature to interfere with and "regulate" telephone rates seems to have lulled a little, although it is not certain that it will not start in again soon. Of course, it purports to be a genuine subscribers' movement, instituted and carried on by the subscribers to the New England Telephone Company as a body. As a matter of fact, it is this in name only. The subscribers are allowing themselves to be *used*—that is all there is to it. Certain persons—subscribers, it may be, but not as subscribers, or because they were such—wanted to fire a telling shot at the American Bell Company. This they thought it best to do by attacking the New England Company, in which the American Bell holds a controlling interest. Accordingly, they sent circulars to all subscribers, getting the names from the printed lists, asking for signatures to a petition. Pretty much all men will, if urged, sign a petition when it *may* result in saving them something, and cannot hurt them. And so many signed, irrespective of, and without even considering, the merits of the case.

With all the vagaries inseparable from a representative body, the Massachusetts Legislature is a tolerably sensible body, and is not much given to sensational or radical legislation. It gives great latitude to all citizens at its "hearings," and is ready to listen to pretty much anything, but when it comes to making laws the questions at issue are pretty carefully considered by a committee of hard-headed and unemotional lawyers, and anything unreasonable, or that has a tendency to interfere with private or corporate rights, is reasonably certain to be sat upon hard. Despite all the fuss that is made about it, the "Great and General Court" of this State is a pretty conservative sort of a body, and I do not think it will go quite so far as to say what prices the telephone companies shall charge for their services, knowing, as they do, that the companies would easily find a way to get round such a law, and that, in all probability, the Supreme Court would upset it as soon as a test case came before them.

It was clearly brought out in the discussions at the Electric Light Convention that upon no subject is there more diversity of opinion, or more lack of exact knowledge, than upon that which concerns the economical use of fuel. And yet upon this, success or failure of electric lighting as a commercial enterprise very largely depends. The estimates given by different persons, founded upon their own experience, differed widely as to fuel cost per light per night. Of course there would be more or less difference, based upon the varying cost of coal in different places, but the divergences noted were by far greater than this would account for, and are to be attributed, in large part, to the different ways of handling fuel, rather than to differences in the fuel itself. This much seemed settled: Those whose grates are so arranged as to leave ample space between the bed of fire and the bottom of the boilers, and who have some suitable arrangement for supplying an adequate amount of fresh air, not only to the fire itself, but to the unconsumed gases beyond the fire, so as to secure their complete combustion, got the best results, while those whose boilers were so set as not to secure these conditions found themselves burning a very large amount of coal, without adequate return in the form of steam. In these times, when competition is very close, where every economy must be looked to all along the line, it is well that attention should be drawn to the subject, and it may be well to state here that the general, though by no means unanimous, concurrence of opinion was that, with a properly constructed setting for boilers, the best results as to economy was to be obtained by using a mixture of anthracite screenings and bituminous coal, the office of the latter, which is used in the proportion of about one-third to one-fourth, being to keep the fine anthracite from packing down and preventing the passage of the air. But, especially when this fuel is used, it is of the utmost importance to supply plenty of air back of the fire, in order to secure the complete combustion of the gases.

The Electric Light Not Injurious to the Eyes.

The disinclination of the world at large to abandon well-beaten paths is exemplified in its general tendency "to let well enough alone." Within certain limits this conservatism is highly proper, but it must be borne in mind that what was well enough in the past is not necessarily well enough now, and to let existing institutions alone, simply because they are in existence, is not compatible with true progress. The objections to the use of gas as an illuminant in New York, a little over sixty years ago, based upon the argument that it would ruin vested interests, and upon vague and hypothetical fears of dangerous consequences—too many of which have unfortunately been realized — have their counterpart in the present opposition to the general use of the electric light. The old opponents of gas were not all interested, even indirectly, in the branches of trade whose ruin they feared would follow the innovation, and it would be absurd now to suspect every opponent of the electric light of connection with the gas interest. We cannot doubt the honesty of many of them, any more than we can doubt the honesty of that eminent man who proposed to eat the first steamship that could successfully cross the Atlantic. They demonstrate their propositions as satisfactorily to themselves as did those other eminent men who showed conclusively, in column after column of our secular and scientific press, the impossibility of the subdivision of the electric current and the folly of Mr. Edison's attempts to accomplish it.

Competition is to be expected, and honest objections must be met and disposed of, but examples of unfair appeals to popular prejudice and to fears of possible evil results are not wanting. A fresh illustration of this fact is seen in the prominence given in the daily papers to an interview with a well-known Chicago ophthalmologist, and first published in the Chicago *Tribune*. It is evident that the doctor's denunciation is intended to apply only to the use of the powerful arc light in inclosed spaces or small rooms, but to the casual reader it is made to appear as applying also to incandescent lamps.

In answer to the question as to whether the use of the electric light has made business better, he (the doctor) says: "I'll not say anything about my business, but I will say that I would not work in or occupy a room lighted by electricity." Then follow the reasons applying, as we have said, to the arc light.

After giving the advantages of the electric light, viz., that "it is a better illuminator than gas, not having the orange ray; it does not consume oxygen and give off noxious gases, and does not give out any heat," the doctor answers, as to the incandescent light, that he "can find no objection to it, because it has about all the advantages of the ordinary (*sic*) electric light, is not dazzling, and maintains a steady glow."

Do the upholders of electric lighting claim more? What more can be desired than the powerful arc for streets and the incandescent for ordinary interior illumination?

The article referred to is headed, "Electric Light and the Eyes; Bright and Beautiful, but a Good Thing for the Oculist." Under many circumstances, sunlight is also "too brilliant and dazzling, producing too much of a strain on the optics." Is not bright sunlight, then, "a good thing for the oculist?"

In the matter of artificial lighting, as in all things, the nearest approach to nature constitutes the highest degree of art. And in the two systems of illumination by means of the electric current—each properly relegated to its own sphere of usefulness—we have certainly more nearly approached nature and nature's methods than by any means yet devised.

EDITORIAL NOTES FROM BOSTON.

The New England Telephone Company's new Boston Exchange is in working order, and in practical daily operation. The removal from the old room across the street, which involved a complete and radical change of system, was effected without a hitch of any kind. It involved likewise an almost entire change of numbers, which was an added element of possible confusion, but everything had been so carefully arranged and provided for that the whole thing went on like clockwork. The operators were quick to learn the working of the new board, and took to them kindly from the start. It seemed a little strange to them to have the whole exchange within the reach of each, and to have no occasion to call from one to the other for a connection, but this was only at the start, and they work along now as though they had never known anything but a multiple board.

The boards, as arranged, are connected up for two thousand subscribers, although they have a capacity for a total of forty-five hundred in all. The boards are of the pattern shown by the Western Electric Company at the Philadelphia Exhibition, and are placed in a long row on one side of the exchange room, there being windows on the opposite side and at the end, so that the whole is abundantly lighted. The operators sit at their work in comfortable swinging chairs, and over each hangs a Weston incandescent lamp, affording ample illumination in the evening. Gas brackets, folded back so as to be out of sight and out of the way, are also provided, and the whole room could be lighted with gas in a moment's time should anything happen to the electric light arrangements. The floor in front of the boards is neatly carpeted, the room is kept scrupulously clean, and the whole place wears an air of refinement not always observable in telephone exchanges.

The method of suspending the transmitters is somewhat new. They hang by flexible conductors from the pulleys, have counterweights behind, and will remain poised at any elevation at which they may be placed. The operators find this exceedingly convenient and a great addition to their comfort, for no two want them at exactly the same elevation. Indeed, no one wants the transmitter at the same height all the time. It is a rest to change it now and again, and this can be, and is, done by a mere touch.

For the present the operators are wearing head telephones. They seem to like them fairly well, but complain that in time they become tiresome and wearing on the nerves. It is not found that the shoulder telephone support works altogether well in connection with the multiple board, because the amount of leaning and reaching from side to side required tends to throw it out of place. I saw, for the first time, one of the new Gilliland head telephones in use, supported from the shoulder. It is practically a cup of chilled iron, with a piece rising from the bottom of the cup. This is the pole upon which the coil is wound, and above it, resting upon the edges of the cup, is the diaphragm. This was in use at the toll line board, and seemed to give entire satisfaction.

A burned dog dreads the fire, and, as the New England Telephone Company has had a large and varied experience with fire, it determined to take all possible means to prevent further trouble in that direction. All the lines which come into the building come in cables—some aerial, some underground. Not one uncovered or single wire goes out of the building. Every conductor in every cable, after going to the cable terminal, passes through, or rather is connected with and through, one of the new heavy current arresters, which have been thoroughly tested in Mr. Gilliland's experimental department. Moreover, as it was felt that a heavy current might possibly be brought on by the bad covering of the cables, these, too, are similarly protected. It costs money to do these things and do them so thoroughly, but it

would cost very much more to omit them, and have the whole establishment thrown into confusion by the accidental coming in of a heavy current as the result of a cross with an electric light wire. In the case of this exchange everything possible seems to have been done, regardless of expense, to provide against such a contingency.

One of the most interesting places in the building is the tower from which the cables diverge, and through which the conductors reach the exchange. The old idea of a heavy frame-work—an exaggerated hen roost—is all done away with. The tower is a large, substantial, comfortable room. In it are the cable terminals, the safety appliances already referred to, and the cross-board, which is peculiar in this, that, while the crossing is done on one side, all in a substantial manner and with no confusion whatever, the connections by means of screw cups are on the other. Thus the connections are all in plain sight and within easy reach—a matter of very great importance when it becomes necessary to make changes.

The batteries, both for testing and for the transmitters, are in the basement, and the current is brought up in cables and from them distributed to the different boards. The wires used in these cables are large, so as to reduce the resistance as much as possible. The generator for ringing subscribers' bells is also in the basement, run by water-power.

Just here it may be well to voice a suggestion made to me by a practical telephone man, Mr. Carty, the manager of the Boston Exchange, under whose supervision the new work has been done and under whose direction the phenomenally successful removal was made. His idea is that in providing conductors for telephone work the telephone current is kept in view, to the partial exclusion of consideration of the magnet's current, which often has a very heavy electromotive force. Indeed, the first generator which was provided for the new exchange was so powerful as to current that Mr. Carty did not dare to use it until some very important modifications had been made in its construction so as to materially lessen the electromotive force of its current. I judge it to be Mr. Carty's idea that it might be better to use several small generators in a large exchange, each to do the work of two or more boards than to have a large one for the whole, on the ground that the heavy current from a large one might in time be found to do injury to cables.

Since the new boards and the new apparatus generally has come into use, there has been a marked improvement in the efficiency of the ex-territorial lines hereabouts. Talking is now comfortably carried on with Springfield and Portland, and the effect of this improvement is seen in the increase in toll-line business. This improvement seems to be mainly attributable to the improvement in the central office apparatus—the old had become somewhat worn and uncertain. Whatever the cause, it is certain that the out-of-town service generally is very greatly improved, and that it is now giving what it certainly never gave before—very general satisfaction.

The express call department of the company's business never was in a more flourishing condition than now. In this department the subscribers, some twenty on a line, are on metallic circuits. They have only a hand telephone and a call. When their drop falls, they simply tell the operator that such an express is wanted to call at such an address. There is no chance for conversation. They send in their message, it is repeated to the express company, and that is the end of it. This department, which has a new board of its own, and is comfortably quartered in the toll-line room, is doing a large business, and is very popular with business men, who find it invaluable in expediting the dispatch of their goods.

Of course, it will be asked how the new exchange ranks as to quickness. Perhaps it had better be admitted that Brooklyn still holds the belt. Not that the new exchange is noisy—not at all. But it is not *noiseless*. The operators certainly talk to their transmitters in confiding tones, but not in tones so absolutely confiding that their next neighbors are unaware that they are talking. There is no confusion, nothing to distract attention, interfere with hearing, or prevent the dispatch of business; but there is a low "hum"—a sustained note—not distracting and not disagreeable, which keeps up as a running accompaniment to the work, and soon ceases to attract attention. Perhaps the newness of the operators to the system is the cause of this, perhaps there are other difficulties which may in time be overcome, but the fact is that the phenomenal, abnormal and almost painful, but at the same time commendable, silence which I noted in Mr. Sargent's Brooklyn Exchange is not as yet to be found in Boston.

INTELLIGENT ASSISTANTS.

At the recent electric light convention the interest manifested in all that pertained to the practical details of operating plants was particularly noticeable, and, although the questions asked were sometimes apparently trivial, yet probably in every one there was a point made that benefited some one among the earnest body of listeners. One gentleman, the manager of an Iowa company, sought special information concerning the handling of help. His complaint was that, by the time an employe could climb a pole and handle a pair of pliers with some skill, he became so much of an electrician that to ask him to heed the words of wisdom that the manager might wish to utter was to cause offence at once. Oftentimes help that was becoming valuable had to be relieved, or the manager take a back seat. This gentleman thought this condition of things applied most forcibly to electric light employes. Perhaps he was right. But proper discipline in this field cannot fail to have the salutary effect that is met with elsewhere. There is not an employe but who may, in his constant work with the tools in his hand, find something that will render that work less difficult—may work out some problem, apparently insignificant, which, in connection with other ideas, assists in making a symmetrical whole. The history of the successful men, whose business demands the handling of men in work requiring some degree of skill, will, we think, bear out the statement that he is most successful who listens to what his men may have to say, and evinces an interest in it. He does not lose their respect, and by such action encourages thought as well as promptness and efficiency from every one. Those who seek for improvement, who go about their work with an intelligent understanding of what is expected as the result, should receive appreciation. Such men are always of value. And the successful manager and operator of an electric light plant—a business that probably requires as much care and intelligence as any of the lines of labor of the present day—is the one who encourages his employes to seek information to be gained, first, by practical, intelligent work, and, second, by the careful reading of such journals and books as will give reliable information as to the results of the experience and research of others. No man of the present day who can read should be expected to blindly perform his task without due comprehension of its results; he should be entrusted with as full a knowledge as his capacity and the work assigned require—should be given opportunity to show what there is in him. Many companies realize this, and are placing in the hands of their employes proper technical literature, indicating thereby their interest in the mental as well as the mere physical improvement of those on whom they depend for the successful carrying out of their plans. If this becomes general, as it should, the end attained will be all that could be desired.

George S. Bowen of the Van Depoele Electric Light Company is looking after the Eastern interests of that company in a general way at present, with headquarters at Astor House.

Electric lighting is now rapidly extending into those localities where, a few months ago, it was a stranger. Its merits are being recognized throughout the Union, and many companies are now able to report that satisfactory condition of business which sees work ahead for several months. Unless all signs fail, there will be more development with better results in the electric light field during the year 1885, than during any two years of its previous history. The REVIEW is pleased to congratulate its many friends among the manufacturers and operators of the arc and incandescent systems on this prosperous condition of things (and which it particularly feels in its constantly increasing list of subscribers), and it begs to assure all that its efforts shall, in the future, as in the past, be directed towards securing from the public that appreciation of their work that it properly merits. That the people are becoming rapidly educated to the beauty, convenience and efficiency of the electric light as a light, no one who has carefully noted the events of the past twelve months can fail to perceive, and we feel that it is not immodest to claim that our efforts to secure this desired end have been most earnest and continued.

We expect to see our most sanguine expectations realized in the development now in progress in electric lighting, and that soon.

There are now 3,385 telephones in use in the city of Chicago. About 50 have been put in so far this year.

Mr. C. D. Crandall, Secretary and Treasurer of the Missouri and Kansas Telephone Company, at Kansas City, has been quite ill for a month past with intermittent fever, but is now convalescing.

The telephone company at Toronto, Canada, have ordered two more multiple switchboards from the Western Electric Company, increasing their capacity from 1,000 to 1,400. They use a number of 20-wire cables, and a few 100-wire in getting into the central office.

Mr. C. F. Annett, President and General Manager of the Rocky Mountain Bell Telephone Company, predicts a good business for his company this year, although matters are quiet at present.

The United Electric Company, Salt Lake City, Utah, has been organized with the following officers: C. F. Annett, President; S. F. Fenton, Vice-President; Chas. S. Smith, Secretary and Treasurer; F. D. Giles, General Manager. They deal in electrical apparatus and supplies.

Mr. J. B. Speed, President of the Ohio Valley Telephone Company, Louisville, Ky., was in Chicago recently, arranging for the completion of the multiple system which is being adopted at Louisville. In two or three weeks he expects to open the new exchange, which will have a capacity of 1,200 subscribers.

Underground Wires in Harrisburg, Pa.

The Municipal Corporation Committee of the House held two lengthy sessions on Monday last to hear argument on the Bennett underground wire bill.

There were present besides the committee, the following gentlemen: Willard Brown, of New York; John R. Read, of Philadelphia, and M. E. Olmsted, of Harrisburg, counsel, and the Marquis D'Infreville, electrician of the Western Union Company; President Bentley, of the Bell Telephone Company, of Philadelphia; President Metzger, of the Pittsburgh Telephone Company; A. J. Decamp, of the Brush Electric Light Company, Philadelphia; Francis Jordan, of the Pennsylvania Telephone Company, Harrisburg, and F. W. Griffin, of the Baltimore and Ohio Telegraph Company. Assisting Mr. M'Gowen were James A. Palmer, of the Brooks Underground Company, Philadelphia, and W. J. McElroy, of the Standard Cable Company, Pittsburg.

The argument was opened by Mr. Brown, who showed that underground conduits are impracticable, and even if practicable, the expense of changing telegraph plant and the increased cost of messages to customers would forbid their use. The Marquis D'Infreville, an electrician of note, followed against the bill, and said that in hundreds of experiments he has not yet been able to find an underground wire system of any good use. Mr. Griffith spoke against the bill, in his remarks, saying that the Baltimore & Ohio placed wires underground in Washington according to the latest plan, but were obliged to cut them out in six weeks because of failure. Francis Jordan, of this city, made a strong argument showing the folly of attempting to do by legislation what the greatest scientists had failed to accomplish. W. J. McElroy spoke in favor of the bill, maintaining that his company now have underground wires in successful operation in various cities. A. J. DeCamp, in opposing the bill, said that if it passed the electric light system of Philadelphia would be swept out of existence. At the evening session Henry Metzger opposed the bill vigorously, giving a practical explanation of the utter failure of underground systems up to the present. He was followed by James A. Palmer, who alleged that the Brooks system is now working in Philadelphia, and is used by the Western Union and Pennsylvania railroad, but only for short distances. President Bentley, of the Bell Telephone Company, occupied the time until midnight making a forcible argument against the bill, and the committee adjourned to meet at 9 o'clock the next morning.

John R. Read, for the Western Union, and against the bill, was the first speaker before the committee this morning. He said this act involves corporate rights in several counties, and claimed that the constitution recognizes the existing system or mode of constructing telegraph lines. At the time of the adoption of the constitution there was no underground method. The legislature has not the power to destroy that which was recognized by the constitution. The speaker quoted legal decisions in support of his assertion. Listening to all the arguments made here, the committee cannot but be in doubt of the feasibility of underground wires. The underground craze, like Know Nothingism, never happens to a man but once in his life. Every known expert in this country was examined on a recent case involving overhead wires in Philadelphia, and after they had all testified, Hon. William Henry Rawle, the master, in his report said that no satisfactory proof has been found that the underground system is perfect and able to supersede the overhead system. The experts at the electrical exhibition in Philadelphia last fall asserted that the system of underground wires is yet in its experimental stage. The speaker quoted from chief electrician Preece, of London, to show that while underground wire may be a partial success in London, yet the atmospheric conditions and climate of this country are such that the same system could be worked here perfectly. This committee should not demand the destruction of a large and valuable plant for the purpose of making an experiment. Those who ask the passage of this bill have their wares to sell. At present there is no demand for them. Not a single underground system has been a success. The Western Union has tried them, and found they would not work. The explosions on the streets of Philadelphia were caused by the electric spark from the underground wires igniting the gas that leaked from the pipes.

Mr. Read then detailed the enormous loss to the Western Union in Philadelphia if this bill passed—a total, he said, of $585,000. The city of Philadelphia itself owns overhead wires valued at $65,000, and they would be destroyed. The responsibility of isolating Philadelphia and Pennsylvania from the commercial world rests with the committee. The penal clause of the bill was then taken up, and riddled, the speaker asserting that no lawyer on earth can draw an indictment under it.

General Superintendent William Ker, of the Harrisburg telephone company, said that were this bill passed the additional expense to subscribers would be three times more than it is now, and at least one-half of them discard the use of the telephone. Steelton, Carlisle, Mechanicsburg and other places would be actually cut off from telephone service. It is simply an impossibility to put the wires under ground.

At the close of the argument, the committee went into executive session and killed the bill by a vote of 18 nays to 2 yeas.

Telephonic News

*** The signs of the times indicate a prosperous year for the telephone people.

*** Geo. L. Masters has been appointed superintendent of the Evansville district of the Central Union Telephone Company.

*** The Western Electric Company are exporting some 400 magneto bells to Europe, and 50 standard switch boards for telephone companies there.

*** There is a very general desire among Western telephone, telegraph and electric light people that the State legislatures hurry up and adjourn.

*** The Central Union Telephone Company reports an increase in the demand for telephones. This is one of the signs that business is improving.

*** We learn that the Western Electric are quite busy in their switch-board department, having recently received orders for upward of 93 Standard switchboards for export.

*** A man in Chicago has invented a new telephone and transmitter. Any town that doesn't possess the inventor of a new telephone is behind time, and is liable to lose caste.

*** At Kansas City the telephone company has its new subscribers announced in the daily press each morning. For ten days past the gain has averaged two subscribers per day, and the manager certainly has no reason to fear comparison with exchanges of other cities if this proportion continues.

*** The application of the Bell Telephone Company for a preliminary injunction on the Clay Commercial Telephone Company, in Philadelphia, to restrain the latter from making an alleged infringement on the Bell patent, was called for argument in the United States Circuit Court last week, but was postponed until the April term.

*** The Pennsylvania Telephone and Supply Company at Williamsport have ordered multiple switch-boards for Williamsport and Wilkesbarre. General Manager Bailey is evidently pushing forward construction in all directions, preparing for increased business. This company is on a sound basis, and has always paid its dividends promptly.

*** An electrician of Kansas City claims to be able to construct an electric motor capable of furnishing all necessary power to run a magneto generator for a large telephone exchange, and only requires ten cells of Callaud battery. The waste and expense which have been the chief characteristics of such motors is said to be absent in this one.

*** Mr. C. H. Haskins, president of the Wisconsin Telephone Company, is visiting the New Orleans Exposition, accompanied by his wife. The Legislature of his State gave him some annoyance the first part of the session by endeavoring to pass a law burying all electric wires, but no injurious legislation is now feared, as the honorable representatives have become better informed on the matter.

*** A merchant of Glasgow, Scotland, has hit upon a very simple though somewhat costly arrangement of telephone wires by which, it is asserted, the annoyances resulting from induction are prevented. His office is connected with his house, some thirty miles distant, by a private line. To prevent disturbance from the induction of other wires, he uses a return wire, and the wires are simply arranged in a spiral or helical form, as follows: Suppose each post to be provided with four insulators, arranged at the four angles of a square. The sending wire is attached to insulator 1 on the first post, 2 on the second, 3 on the third, 4 on the fourth, 1 on the fifth, and so on. The return wire is attached to the insulators at the opposite corners of the square, or what would correspond to that position, thus forming the helix. The arrangement is said to work so perfectly that the passage of telegraphic messages on neighboring wires does not produce the least disturbance.

Asking for Increase of Capital.

In the legislature on the 5th inst., in Boston, the committee on mercantile affairs took up the petition of the American Bell Telephone Company for an increase of capital, and of a number of other petitioners for more thorough State supervision of telephone lines, and for a regulation of charges. Ex-Senator Bruce appeared for the Bell Company to ask for the increase of capital. He spoke of the wonderful discovery and development of the telephone. Mr. Bell, said Mr. Bruce, held in his hands the most wonderful invention of his age. While attempting to solve the question of its use the Bell Telephone Company was formed under the general laws of Massachusetts with a capital of $450,000. It proved inadequate, and the New England Company was organized. This, too, proved unequal to the work, and the National Bell Telephone Company was formed, with a capital of $800,000. It was at this time that a host of *ex post facto* inventors sprang up, and the era of litigation began. The Western Union Company made its contract with the telephone company in 1879. In 1880 the telephone company appeared to the legislature for an increase of its capital to $15,000,000, and the legislature fixed the limit at $10,000,000. They now asked permission to increase their capital stock $20,000,000 more. It was under this company that the telephone system had been developed. It had 100,000 miles of wire—more than had been built for telegraphic lines in the United States in half a century. The whole telephonic system was divided into districts—one for Maine, Vermont, New Hampshire and Massachusetts, one for Rhode Island, three in the State of New York, and so on. What the company now proposed to do was to connect the systems in the United States together so as to establish communication between every part of the Union,—so that a man in Cottage City in the little Island of Martha's Vineyard could communicate at once with a man in New York, Washington or Chicago. It was just as feasible now to talk over these distances as it was in the earlier days of the invention to talk between Boston and Cambridge. The time might come within the lives of the members of the committee when one could listen in his own house to the debates in Westminster Hall, or a sermon in St. Peter's. If the company could have their increase of capital, they were prepared to build 150 lines between New York and Boston, and other lines all over the Union, making 247,720 miles of wire. This first venture would cost: For poles, $1,000,000; copper wire, $9,000,000; rights of way, $1,000,000; stringing these lines, $2,500,000, making a total of $13,500,000. The company asked for the increase in capital for this purpose, and for no other. If the business is legitimate, the means of carrying it on must be granted.

The largest corporation in the world is the Suez Canal, which has a capital of $300,000,000. There was no reason, which Mr. Bruce could possibly bring into his mind why the increase of capital should not be granted. New York, New Jersey, Pennsylvania and Iowa, and perhaps a majority of the States, allow the formation of corporations under their general laws without any limit as to amount of capital. The work of extending the telephone is going to be done. The men who control it want it done under the laws of Massachusetts, for it is by citizens of this State that all the great discoveries in electricity have been accomplished.

Mr. William H. Forbes, president of the American Bell Telephone Company, stated that the company had found they were only at the beginning of their business. The increase of capital was asked at present for the connection of different systems, and for other needs which might arise. New York and Philadelphia would be first connected; then New York and Boston, and as the public demand justified it the lines would be extended. There were no patents to be purchased, except small ones. The company paid about $23,000 in taxes last year in Massachusetts. The combined capital of the minor companies throughout the country was something over $50,000,000. There had already been a demand from large houses in Boston and New York for private wires.

Mr. Edward Atkinson said he was merely a prospective user of the long distance telephone. He had no interest in the company. It would be a great benefit and convenience to have long distance telephoning.

Colonel Jones H. French testified that he was a member of the State Senate in 1880. He regarded the demand for a capital of $15,000,000 for the telephone company as extraordinary, and opposed it. He had taken occasion to watch the business quite closely since, and he was convinced that $10,000,000 was to-day too small a capital. He regarded $30,000,000 as not too great a capital, and thought it would eventually prove much too small. These great companies should be kept in Massachusetts. Colonel French thought rates ought to be regulated only as to charges by the law of supply and demand Legislation he did not regard as beneficial. Mr. Henry L. Higginson, of Lee, Higginson & Co., said his firm had asked for a line to New York for five years past. It would be an improvement over the telegraph.

Mr. Francis Blake, the inventor of the Blake transmitter, said that at first long distance telephoning was thought to be impossible. Too frequent vibrations close the circuit permanently of an ordinary telegraphic receiving instrument, but practical experiment showed that the vibrations of the human voice could be transmitted. A new transmitter had just been patented of great power, the sounds through which could be heard 50 feet away from the transmitter in a quiet room.

Mr. Bruce said that this would close his case, but if the committee wished to test the success of long distance telephoning they would be welcome at the company's office.

The Telephone Controversy.

In the Massachusetts legislature the Committee on Mercantile Affairs gave the final hearing, last week, upon the petition for legislation compelling the telephone companies to give the same facilities to the other telegraph companies that they give the Western Union. Mr. George S. Hale, counsel for the Western Union Telegraph Company, made a full argument on the unconstitutionality of an act which would interfere with patents granted by the United States, and should force the breaking of a contract such as now existed between his company and the Bell Company. He read several decisions on the illegality of laws which should restrict the owner of a patent, and a recent decision in the State of Connecticut, declaring that the law could not compel the Bell sub-companies, who were granted rights under patents owned by the Bell home company, from breaking their contract with the home company and using the telephones contrary to their agreements with the owners of the patents. Mr. Hale stated that the Western Union Telegraph Company had paid $100,000 in taxes in this State since its incorporation, and the chief advocate for the new law, the Baltimore & Ohio Telegraph Company, had not as yet paid the State a single dollar for taxes; he felt that his company deserved the most consideration of the State. He did not believe that the Bell Company recently wanted this new law; the contract between the Western Union and the Bell Company was made at a time when the Western Union was engaged in the telephone business under its patent. It gave up this business, and agreed to quit the title of the Bell patents if the Bell Company would give it all its telegraph business; this was the consideration, and it was a very valuable one to the Bell Company. This consideration having been annulled, it was a question whether there was any mutual advantage to the telephone company left. The State could not pass a law invalidating a contract legally made at the time, under its subsequent amendments to the charter, or the general laws could not take effect, so far as this old contract had taken effect. Mr. Hale offered an amendment that this new act should not take effect if the contract referred to were legal when made.

Mr. Parker C. Chandler, counsel for the Baltimore & Ohio Telegraph Company, in reply to Mr. Hale said that the Western Union Company's payment of $100,000 taxes to this State is offset by the fact that the Baltimore & Ohio Telegraph Company had already saved the State in a single year $150,000 in reduced rates. It could save the public much more than this if it had the same advantages in telephonic connection. The State does not owe the great telegraph monopoly anything because it has paid its taxes. That is more than offset by the exclusive right it has in all the railroads of the State, all the highways, and legally or illegally on all our roofs, and by the $1,000,000 in tolls it collects each year from our citizens. Mr. Chandler stated that the law is that the States cannot interfere with the United States patent laws. Now what do the United States patent laws regulate? Simply the manner in which patents shall be obtained and how they shall be assigned and sold. This is the whole purpose and interest of all the patent laws. Any interference with these regulations the State cannot legally make. The United States guarantees to the inventor a property right in his invention, his letters patent secure to him a monopoly in the thing patented, so that the right to make, use, or vend the same is vested exclusively in the patentee. The right to enjoy the invention is secured to the patentee, and he is protected by the federal government against all interference with his right to his patent. The sole operation of the patent laws is to enable him to prevent others from using the products of his labors without his consent; but his own rights of using are not enlarged or added to. The property of an inventor in a patented machine, like all other property, remains subject to the paramount claims of society, and may be curtailed and regulated by State laws when the public welfare requires. The tangible property which comes into existence by the application of the discovery patented is not beyond the control of the State government, merely because the patentee acquires a monopoly in the discovery; his and his property's relations to the State are not altered. It cannot take from him his patent or prevent him selling it; but the State can under certain conditions prevent his using the machine made under his patent, can tax the mechanism and the corporation making profits out of it, and can regulate its manufacture and use when it is dangerous to the life of citizens of the State, as patented powder, gas, oil, and dynamite, or when it is contrary to the morals of the State, as a lottery machine or immoral books or pictures, or when it is used by a corporation under State charter or regulation, more particularly when it is doing a public business like a common carrier. The railroad companies may make a hundred contracts for patent rails, switches, cars, and engines, but it must, as a public servant requiring public patronage and State privileges, a charter from the State, the use of the highways, submit to the conditions and regulations which, in the judgment of the law-making power of the State, are necessary to promote the public good. Mr. Chandler, referring to the right of the State to pass a law which should interfere with the contract made by two corporations, argued that the contract between the Western Union and the Bell Company was illegal, because it was contrary to public policy, in that it created a monopoly and was an exclusive contract, such as the courts had again and again declared illegal. But if it were a legal contract, it was made by the Western Union Telegraph Company with the full knowledge of the Bell charter, which specially provides that the Bell Company shall be and act subservient to the right of the State to amend its charter, and also be subservient to the general telegraph laws of the State and all amendments thereof. Even if the Western Union Telegraph Company should be deprived of its exclusive right to use the telephone to receive and send telegraph messages, the consideration in the now famous Bell and Western Union contract would not wholly fail, because the Western Union would still continue to receive one-fifth of

all the royalties of the Bell Company, and thus profit by the increased telegraph business created by giving all telegraph companies the right to be called and to transmit messages to all those who rent telephones. Mr. Chandler then presented the following draft of an act:

SECTION 1. Telephone companies owning or operating telephone exchanges shall, on the application of any telegraph company, furnish the company so applying with telephone connection with their respective exchanges and service, without discrimination between telegraph companies as to such connection, service, or use of the instruments furnished or charges therefor.

SEC. 2. Any court having equity jurisdiction, in term time or vacation, shall, upon application by any suitable process or decree in equity, enforce the provisions of this act

SEC. 3. This act shall take effect upon its passage.

Mr. Greenhaige, of Lowell, a lawyer on the committee, then asked Mr. Hale to send him an answer to the following interrogatories: Is the legislature bound to inquire into the position occupied by the parties a-king for charter or chartered by it? Does the legislature concern itself with the question of patents as they may enter into the machinery used by this corporation? Is not the question to be considered by the legislature simply upon what terms and conditions the charter shall be granted and how the business shall be conducted, especially with reference to the public?

Ancie t Chinese Telephones.

At a recent meeting of the Royal Asiatic Society in Shanghai, a paper by Dr. Macgowan was read on the subject of the early use of telephones in China. This paper being very brief, we give it in its entirety:

It detracts nothing from the merit of the ingenious physicists who have conferred on mankind the boon of the telephone, that its principles are familiar to uncivilized peoples, several of whom are in possession of rudimentary telephones. It was, I opine, when the Chinese were in their youth that they constructed the rudimentary instrument, a specimen of which I have transferred to the society's museum. It consists of two bamboo cylinders, one and a half to two inches in diameter and four in length; one end of each is closed by a tympanum of pig bladder, which is perforated for the transmitting string, the string kept in place by being knotted This rude instrument is styled the "listening tubes," and is employed for amusement as a toy, conveying whispers forty or fifty feet. It is unknown in many parts of the empire, Chih-kiang and Kiangsu being the only provinces (so far as I can ascertain) where the listening tube is employed.

Besides this toy, Chinese ingenuity produced, about a century and a half ago, the "thousand-mile speaker." The implement is described as "a roll of copper, likened to a fife, containing an artful device; whispered into and immediately closed, the confined message, however long, may be conveyed to any distance; and thus in a battle secret instructions may be conveniently communicated. It is a contrivance of extraordinary merit," The inventor of the "thousand-mile speaker," Chiang Shun-hsin, of Huichou, flourished during the reign of Kang-hsi, A.D. 1662-1772. He wrote on occult science, astronomy, etc. The above account of his invention was taken from his works by the author of a Fuhkein Miscellany. At that time—reign of Kien Lung—there was no longer an instrument of this description in that province. It seems to have perished with the ingenious scientist who contrived it.

Here is a fine opportunity for the organization of a new telephone company, with a legal department to hunt up the lost evidence, and take a whack at the Bell telephone monopoly. Doubtless many heathen Chinee might be found glad to testify they had often used the old telephone in talking from the Great Wall to Pekin, and further if necessary.

The sale of the American Rapid plant and franchises to the Postal Telegraph company has been made contingent upon the failure of the Bankers' and Merchants' company to meet its obligations.

Orchorowicz Telephone.

In this instrument, which is stated by M. Hospitalier, in *L'Electricien*, to be the most powerful he has heard, the inventor has sought to transmit to a distance speech, as well as vocal and instrumental music, with such clearness that an opera—for instance—may be heard by several people some distance from one another, and without having to bring the receiver to their ears. The system comprises a microphonic transmitter of new and special construction, and of a magnetic receiving telephone, the magnet of which is a solid steel cylinder with a slot down the length of its surface 5 or 6 mm. (¼ in.) wide, with two soft iron cores 3 or 4 mm. in diameter about the middle and carrying coils. The latter are enclosed in a kind of flat box, formed of two thin iron plates, one at the top opposite the cores (as in ordinary telephones) and the other at the bottom, screwed to the middle of the magnet The lower plate is pierced with two holes of a larger diameter than the soft iron cores which traverse it, so as to move freely without touching, these two circular and parallel plates being connected together at their outer edges by a metal crown. In this way, the two plates are only fixed by a point, that which connects the lower plate with the magnet; they form a kind of vibrating box very mobile and elastic, which contains the coils. When the undulating current, modulated by the transmitter, passes through them, it modifies the flow of force inside, increasing or diminishing it. The box closed by the two plates contracts or expands under the influence of these variations of intensity, vibrating throughout its whole substance, thus accounting for the remarkable power of this telephone. It is also capable of acting as a magnetic transmitter, and permits of speaking and hearing in the same manner for a certain distance; but in this case the effect is considerably less marked than with the microphonic transmitter.

Overhead Wires in Philadelphia.

THE BOARD OF TRADE SUIT AGAINST THE BRUSH COMPANY DISMISSED.

William Henry Rawle recently filed his report as Master in the suit of the Commonwealth, at the instance of the Board of Trade of Philadelphia, against the Brush Electric Light Company. The suit was brought to compel the company to lay its wires underground, and the court was asked to restrain, by injunction, the maintenance of its posts, poles, cables, and other encroachments upon the highways. The Master reports that there are strung upon the company's poles fifty-five miles of wire, of which fifteen are used by the city for public lighting and forty for private use. The poles and wires are component parts of the apparatus for producing the electric light, whose benefit to the general public the Master dwells on at length. He finds that the wires are not a source of danger to travelers on the highway by reason of the electric current with which they are charged, nor do they increase the risk of property in the event of fire, although he admits that if all overhead wires were removed easier access could be had by ladders to burning buildings. He further finds that no satisfactory proof has been made that the underground system has as yet been found to be so effective as to supersede the present mode of overhead lighting.

He then discussed the scientific testimony as to the cost and practicability of laying electric light wires underground, and remarked: "However this may be, the plaintiff's right to the injunction claimed, whereby the defendant's work would be put practically out of existence, does not depend upon the fact that it is possible at a greater or less expense to put its wires under ground. If it appears that the latter is acting under lawful authority, and that what it is doing is not a public nuisance, it should require a very clear case to justify judicial action by injunction. It may be admitted that the fifty-five miles of wire as now hung are objectionable; highly so. So are the telegraph and telephone wires, whose extent was estimated by one witness to be as great as 20,000 miles. They are unsightly to the eye; their poles are certainly obstructions, and in case of fire, though it cannot be said that they generally and seriously prevent access to houses by ladders, they certainly do make them less accessible. For these reasons the hope has more than once been expressed from the bench, and widely gone through the community, that all these wires should at the earliest day possible be arranged under ground in such conduits or subways as may be best adapted to that purpose"

The Master concludes his report by referring to the just published report of the examiners on underground conduits in the Electrical Exhibition of the Franklin Institute, reporting that it seemed to them unadvisable, in view of the present rapid advance of electrical science, for any company to commit itself to a particular style of plant He therefore reports that the bill should be dismissed, without prejudice to any right which the plaintiff may have to proceed at law.

The Rocky Mountain Bell Telephone Company is experiencing a new trouble at Salt Lake City. The stand the United States officials have taken against polygamists has caused quite a number of the interested saints to visit foreign parts, and the telephone collector finds his bills accumulating on his hands, and no funds forthcoming. Even when he is successful in discovering one of the "persecuted," he is generally refused admittance, the saint fearing that he is one of Uncle Sam's Greeks, bearing a gift in the shape of a summons, and that he has assumed the guise of a telephone man to them by being able to get to the presence of the concealed Mormon and serve it. For the present the Mormon subscriber is able to credit the telephone with furnishing the silver lining to his cloud of United States law, inasmuch as the payment of rental bills is postponed with what is, to them, an excellent excuse.

The Michigan Bell Telephone Company of Detroit have ordered an additional hundred miles of hard-drawn copper wire from the Palmer company this week. The Palmer company has also been exporting considerable wire of late to the South American countries.

.... There is a war among the telegraph men in Brooklyn just at present, owing to a change of base of the Bankers and Merchants' Telegraph Association. The employees of that organization have suddenly been left out in the cold, and the United Telegraph Company, which has seemed to spring up like a mushroom in the night, has stepped into its shoes. The employees of the Bankers and Merchants', including Mr. Rochford, the manager of the Brooklyn office, received a forty-eight hours' notice that their services would be no longer required, but nothing was said concerning the settlement of the debts. The poor girls who were employed in the branch offices, the messenger boys and others set up a howl of indignation. The United Telegraph Company was a little telegraph school in Brooklyn two years ago, and therefore does not come in with years of experience or with any particular wires except what were left by the American Rapid Telegraph Company a few years ago. The Merchants and Brokers' was in the hands of Mr. J. C. Smith as a receiver, and that gentleman now appears as the general manager of the new company. Mr. Rochford said he felt sorry for the employees, and he thought it would be necessary for the new company to pay the rent for the offices which the Bankers and Merchants' had occupied before they could take possession of them or take the instruments. Mr. Rochford is to take the management of the Postal Telegraph Cable Company. James B. Butler, formerly Appointment Clerk of the Treasury Department at Washington, has been appointed Receiver of the Bankers and Merchants' Telegraph Company, to succeed James G. Smith and Richard S. Newcomb Mr. Butler represents no especial interest, but is appointed upon the unanimous recommendation of the creditors.

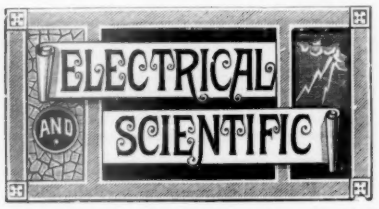
TELEGRAPHIC

.... From experiments on partially closed magnetic currents of iron, Mr. Werner Siemens has been led to infer that the harder a specimen of iron is the greater is the value of the magnetizing force at which the maximum of permeability is observed. He also finds that the magnetic resistance of air is from 480 to 500 times as great as that of iron.

.... It is claimed that a New England firm has introduced a new process for galvanizing wire. It is claimed that by this new method a thorough union of the coating with the body of the wire is secured, and that in every case a smooth, firm surface results. Great softness, tensile strength, and uniformity of temper are also said to be obtained in the wire, while the coating itself remains intact after the wire has been tested by severe twisting.

.... Mr. Stone, the operator at the depot, relates a curious instance of what telegraphic wires will do. Sunday night he was in his office, when he had occasion to adjust the relay of his instrument. As he bent down closely to it, everything being very still, he distinctly heard messages that were received in the Macon office. It was not going over his wire, and he heard it as if through a telephone. The peculiar condition of the atmosphere and the wires probably caused the induction.—*Americus* (Ga.) *Recorder*.

.... Our correspondent at York, Pa., says the Western Union Telegraph Company has again failed in its efforts to prevent competition, the Baltimore and Ohio Telegraph Company having opened an office in this place, with a sweeping cut in rates. The line from Baltimore—sixty miles—has been completed within fourteen days, with the thermometer much of the time below zero. Poles have been cut in the woods since February 1. Telegraph men generally will appreciate this remarkable work. The line had been completed to the suburbs of York before the Western Union Company was aware of its existence, and, although the City Councils had granted necessary rights to build the line through the streets of York, steps were taken by the Western Union Company to prevent its construction. The City Solicitor was retained, and an opinion given against the rights of the competing line on the ground of some technical inefficiency in their Pennsylvania charter. The Chief Burgess and Police Department were prevailed upon to stop the work and the Baltimore and Ohio workmen were arrested. The Baltimore and Ohio, however, soon satisfied the city officials of their mistake, and upon filing a bond for $10,000 damages, were permitted to construct the line. The citizens of York are highly indignant over the attempt by the Western Union to obstruct the Baltimore and Ohio line; so much so that at the city election on Saturday the former City Solicitor, who had been retained by the Western Union Company, and who was a candidate for re-election, was, much to his surprise, overwhelmingly defeated. This is not the first instance in which leading attorneys have taken retainers from the Western Union Telegraph Company in opposition to the Baltimore and Ohio Company, and as candidates for office have been defeated. We are told that Judge Todd, of Texarkana, was employed by the Western Union Company to oppose the construction of the Baltimore and Ohio along the Missouri Pacific Railroad. Soon after he was nominated for County Judge, and while not only competent, but exceedingly popular, the fact of his being in favor of telegraph monopoly led to his defeat. Mr. Marion, agent of the Missouri Pacific Railroad at De Kalb, Texas, ran for County Clerk, and was defeated because he had taken active steps to help the Western Union Company in their fight against the Baltimore and Ohio. When the public have an opportunity of expressing an opinion against would-be monopolies, they do so in an unmistakable manner.



* * Official statistics show that the total production of copper in this country last year was about 150,000,000 pounds, against 115,500,000 in 1883, an increase of 30 per cent. The gain was largest in Montana, that territory having turned out 44,500,000 pounds, against 24,000,000 in 1883. The increase in the Lake Superior region was 8,800,000 pounds, and the Arizona 2,700,000 pounds. These figures are of themselves sufficient to explain the decline in price of ingot and the wane of the power of the old Lake Superior "combination."

* * Dr. Elroy M. Avery, of Cleveland, O., manager of the Brush-Swan Electric Light Company, lectured before and for the benefit of the Ithaca High School scholars, on "Electricity," the other night, bringing together a large audience of Ithaca's most intelligent citizens. He had with him a large number of apparatus, and made his subject intensely interesting. The *Journal* says he spoke for two hours, and no one wanted to go home. Dr. Avery, as our people understand, is the manager of the Brush-Swan Electric Light Company, of this city, and a frequent visitor to town. Why not our High School take advantage of the opportunity, and get him to tell the people what he knows about the subject?

* * M. Reynier has established at Friburg, Switzerland, a manufactory of accumulators, which are to be of two kinds, one, devised by himself, with zinc and lead electrodes, and the other with lead plates only, after Plante's method. The usual type contains three pairs of plates, and weighs half a cwt. M. Reynier considers that he is able to store up 86,000 kilogrammeters (622,050 foot-pounds), which corresponds to a capacity of 3,440 kilogrammeters per kilogramme of accumulator, or roughly 10,000 foot-pounds per pound (including lead, glass and liquid). As each plate weighs 2.8 kilogrammes, this corresponds to a capacity of 5,120 kilogrammeters per kilogramme, or 16,878 foot-pounds per pound, of lead. Thus, remarks the *Bulletin International des Telephones*, it has been found possible to get 19 horse-hours out of a ton of lead, a feat hitherto unaccomplished.

* * There was an interesting exhibition in Philadelphia, last week, of the Bidwell electric railway system, which was witnessed by many railroad men and representatives of the press. The track was 250 feet long, and the car—an open one, finely upholstered—was large enough to seat ten persons. Its motion was smooth, easy and rapid, considering the numerous curves that were necessitated by the limited space, and the same agent that gave it motion was utilized in lighting and heating it. The dynamo from which the electric current is supplied was of five horse-power. By two levers in the rear of the car it was easily kept in perfect control, the engineer being able to make it move backward or forward, slowly or quickly, or to stop or start it at will. No brakes are used in this system, the counter electric current which is set up by the direct current in the motor acting as a brake when the direct current is shut off. The same current that moves the car is made to light it by means of a number of Edison incandescent burners, and to heat it by passing through a resistance coil under the floor. The dynamo can be operated either by steam or water-power, and may be located near the railway, or several miles away from it, if necessary. The current can be carried by wires to the conductors, which are laid beside the tracks on elevated roads, and carried to the motor in the cars. In surface roads, it was explained, the current may be applied in a slot in the center of the track, while in elevated roads the conductors may be placed beside the rails. The system is the invention of Benson Bidwell.

* * Wright, the United States Commissioner of Labor Statistics, being asked how the new bureau, of which he is the head, could benefit the workingmen, made this thoughtful reply: "It can help them by bringing to them a wider knowledge of the forces which belong to industry. If the laborer and his employer can be taught that their interests are not as they have been told, identical, but on the other hand, reciprocal, much will have been done to secure reciprocal peace. If he can learn through investigation that wages are the result of laws outside the control of himself and his employer, he has learned much toward securing his own comfort. If his employer can learn that with broad, humane, Christian treatment which is epitomized by the golden rule, he receives better and surer dividends, and that his works and his enterprises are safer and more secure, the laborer has been helped in an inestimable degree. These are a few of the directions through which aid can be brought to the laboring classes by a bureau of the kind in question."

* * The results of the first experiments in domestic lighting by the battery of MM. Buchin, Tricoche et Cie, appear to the *Bulletin International des Telephones* to confirm the favorable opinion formed of it by our contemporary, who says that, to maintain an incandescent lamp of eight volts, giving an intensity of three candles, it is sufficient to employ a 6-element No. 2 battery, of 65 by 63 mm. surface and 14 cm. high (2½ by 2⅜ by 5½ inches), containing one zinc and four carbon electrodes specially prepared. The first cost is about 25fr. (£1) for Swan lamp and battery; and the expense of maintenance is put as follows:—400 grammes (1lb.) of bichromate of potash at 1 fr. 50c. (1s. 3d.) per kilogramme (2.2lb.), 60 centimes or 6d.; 500 grammes (1.1 lb.) of sulphuric acid at 40 centimes (4d.) per kilogramme, 20 centimes (2d.); zinc, 50 centimes (5d.); total, 1fr. 30c., or a little over a shilling. After being charged, the battery is said to work for four hours uninterruptedly, so that the cost is 33 centimes, or about 3d. per hour of light. This type of battery will also work for eight hours consecutively with the same zincs, on changing the liquid after four hours' action.

* * The chief application of iridosmine in the arts has been the pointing of gold pens, iridosmine being the so-called "diamond point" of the pen manufacturers, which consists simply of a small grain of iridosmine which has been selected for the purpose and soldered to the tip of the pen. These points are selected by first removing from the ore, by means of a magnet, the magnetic oxide of iron which always accompanies it, and then dissolving out, by means of acids, the other impurities which may be present; the ore is than washed with water, dried and sifted in order to remove the fine dust, and the sifted ore is then ready for the selection of points. This is done by an operator, who rolls the grains of iridium around with a needle point, examining them under a magnifying glass and selecting those which are solid, compact and of the proper size, color and shape. These points are usually selected in three grades, small, medium and large, depending upon the size of the pen for which they are intended to be used. The grain of iridium having been soldered on the end of the pen, it is sawed in two (which makes the two nibs of the pen), and ground up to the proper shape.

* * In a paper on accumulators before the Societe Belge d'Electriciens, M. Rene Tamine, Ingenieur des Ponte et Chaussees, concludes that a study of the secondary currents generated by the voltmeters of various metals permits (1) of establishing a methodical classification of accumulators, and (2) of practically realizing the accumulator which possesses a maximum of electromotive force. When a voltmeter formed with lead, copper, iron, or zinc (leaving the precious metals out of the question) immersed in diluted sulpuric acid, be subjected to the action of a primary electric current, and the effects produced during the discharge, that is to say during the action of the secondary current, it is found that (*a*) the lead is the only one of the above-named metals which produces on the electrodes, under the influence of the charge or the discharge, an oxide insoluble in diluted sulphuric acid, and (*b*) the E.M.F. of the current depends especially, with copper, zinc, and iron, on the activity of oxidation of the spongy layer formed on the negative electrode during the charge. With the lead, on the contrary, the E.M.F. depends especially on the energy of reduction of the layer of oxide formed on the positive electrode under the influence of the primary current. The first of these conclusions supplies an explanation of the phenomenon of polarization in lead accumulators.

* * In order to preserve a stable ratio between money volume and population and wealth an annual increase of not less than $40,000,000 of currency of some kind is now required. In other words, the increase of population and wealth calls for an addition to our circulation of at least $40,000,000 a year. If while these conditions continue silver is coined at the rate of only $28,000,000 a year, there is left still a considerable void to be filled with gold.

Mr. Horatio C. Burchard, director of the United States Mint, recently furnished figures showing the metallic and paper currency in the hands of the people of the United States and in the banks on January 1 of each year, beginning with 1878 and ending with 1885. The following are the amounts for the two dates mentioned:

	Jan. 1, 1878.	Jan. 1, 1885.
Gold coin.....	$110,000,459	$392,457,982
Gold certificates..	26,409,300	93,287,420
Silver coin.....	61,260,168	94,818,640
Silver certificates.	.....	114,865,911
Bank notes.....	310,084,493	318,828,629
Treasury notes...	288,203,336	310,181,441
Totals.....	$795,957,756	$1,324,440,023

In those seven years the circulating medium of the country increased $528,482,267, or at rate of more than $75,000,000 a year. This increase is nearly double the $40,000,000 which the silver advocates ask for "in order to preserve a stable ratio between the money volume and the population and wealth" of the country.

Mr. N. P. Hill, probably one of the ablest and most pronounced silver men of the country, in an address in the United States Senate about three months ago, used these words: "The least measure of the increase of money necessary to keep prices of commodities from falling is an increase proportionate to population, which is for this country about 3 per cent. per annum." This would be an increase in the volume of currency of about 21 per cent. since the beginning of 1878. The actual increase, however, has been, as seen by the figures of Mr. Burchard, in a ratio more than three times as great, or about 66 per cent. The silver men will hardly contend that the volume of the circulating medium was not large enough to supply all the needs of a tool of exchange in 1878 or 1879.

It will be seen, therefore, that the expansion of the currency has been much too great in the seven years just ended, even when estimated on the basis of annual increase demanded by the silver coinage advocates.

Of course the leading financial authorities of the world base the amount of currency which a country needs not on its population but on the volume of its exchanges, the rapidity with which its money circulates and the extent to which it uses drafts, checks, bills of exchange and other money-economizing contrivances.

Gas.

Some one has taken the trouble to ascertain the cost of supplying gas to customers in ninety-five of the principal cities of the country and finds the price to range from ninety cents to four dollars per thousand feet. The price, of course, varies in accordance with the proximity of coal supply and the quantity of gas furnished. In large cities it is, or should be, cheaper than in small ones.

The lowest price is reported at Wilkesbarre, Pa., and Wheeling, West Va., near the coal regions, and the highest at Galveston and San Antonio, Texas, places that are remote from the coal mines. The cost is doubtless governed in many places by the amount of competition. Where there is but a single company the price is generally such as the average soulless gas company has the cheek to demand. But when two or more companies are asking public patronage, prices are reduced—at least until the competing concerns can combine, and divide the territory between them.

The price in this city at the present time is $1.50 net, with an extra charge of 20 cents, to enforce prompt payment. This is perhaps about a fair average between the highest and lowest rates in the several cities. And yet Buffalo has more than an average location with reference to coal-supplying facilities, and, therefore, is paying more than a proportionate rate for its gas. But this city is better off in this respect than some other places in the State. Rochester pays $2, Albany $2.50, Auburn $2.25, Oswego $2.25, Poughkeepsie $2.14, Syracuse $1.80, Elmira $2, and other places similar rates, all of them paying more than Buffalo, so that there is perhaps little reason to complain.

Baltimore, Pittsburgh and Chicago are supplied at $1. It is easy enough to see why Pittsburg should get such cheap gas, but it is not so readily understood why Chicago and Baltimore should be so fortunate. Their coal supply undergoes hundreds of miles of transportation. Philadelphia, that is certainly more favorably situated than Baltimore, pays $1.70 and New York $1.75, while Boston, still further away, is on the list at $1 50.

It is ascertained that the price of gas has been reduced somewhat since the introduction of light by electricity. The old gas companies made a desperate fight against electric lights, but they have come, and come to stay too. If it does not make any cheaper light, it provides a better one, and will largely take the place of gas.

A New Primary Battery.

The recent attempt to destroy the Houses of Parliament by dynamite has been the cause of bringing to public notice a new electrical apparatus designed for use in small boats on rivers, generally, and on the Thames in particular. A series of experiments was made on Tuesday evening (Feb. 10) by Mr. Isidore Spielmann in connection with the apparatus, which is, in the first place, intended for the use of the river police in patrolling the Thames opposite the Houses of Parliament. The object in view was to throw a strong light from the middle of the river on to the Palace of Westminster. The difficulty to overcome was the obvious one presented by the size of the police boats, which does not admit of their being fitted with engines, dynamos or bulky accumulators. The only source left is that of the primary battery, and from this was derived the light with which the trials of Tuesday night were made. The battery used was the invention of Mr. George de Skrivanoff, a Russian inventor, who died recently. It consists of boxes containing a number of small cells not more than one inch in width, in which are placed zinc plates and chloride of silver. The excitant is a weak solution of potash. A battery thus made may be worked, it is stated, for many hours without diminution of its strength. When the battery has expended its power, the chloride of silver, which does not waste in use, is easily and cheaply reconverted. The whole of the power on Tuesday night was obtained from two boxes, each measuring ten inches long, eight inches wide and eight inches high. With it an arc light of at least 250-candle power, throwing very powerful rays, was produced. From the middle of the river the features of persons on the Speaker's Terrace were clearly discerned, and when the little launch used for the experiments was close to the Surrey side, people walking on the terrace and the bridge could be clearly distinguished, while the approach of small boats from up or down the river was noticeable for a great distance. It is believed that the object sought, of instantly detecting any nocturnal attacks of the dynamite conspirators, will be fully attained by the use of this invention.

Electrical Transmission of Power.

M. Cornu has reported on the experiments made on 4th March, 1883, at the works of the French Northern Railway, as to the application of M. Deprez's dynamos to the transmission of power along a telegraph wire. The generating machine (a Deprez No. 20) was connected with the receiver (a D Gramme machine transformed) on one side by a short wire of but little resistance, and on the other by a 4mm. galvanized iron telegraph wire, 17 kilometers = 10½ miles long, passing through the Bourget station. These conditions, although not identical with those which are usual in the electrical transmission of power, did not appear to the commission sufficient to detract from the value of the experiments, as continuous and not alternating currents were employed. The results of the measurements are of two kinds—dynamometric, relating to the power transmitted; and electric, relating to the electromotive force developed in the generating and receiving machines. The following are the principal conclusions deduced from the tables of dynamometric and electrical results which were obtained: "The work absorbed by the generating and transmitted to the receiving machine increased with the speed of the generator, attaining 4½ horse-power for a speed of 1,024 revolutions, against an effective resistance of 160 ohms, representing a double telegraph line 8½ kilometers, or 5 miles long. The gross yield amounted to as much as 37½ per cent. of the work expended; and, if the mechanical motor be allowed for, so as to arrive at the result produced by the successive transformations of energy, the dynamometric result even reached 48 per cent. The table of electrical results shows that the telegraph line practically offered, while the power was being transmitted, that is to say with a current of 2½ amperes, the resistance of 160 ohms which was recorded with a current of 0.01 ampere during the former experiments. This observation appears to sufficiently establish the agreement of theory and practice so far as concerns an analysis of the phenomena of transformation of energy in the circuit."—*London Electrician.*

Electricity on Cancer.

Each passing day brings to light some new development of the wonderful power of this electric fluid. The eminent Dr. D. D. Ross, of Peoria, Ill., who for over 26 years has devoted his best energies to the study and alleviation of this baffling disease, declares that there is nothing which can so safely exterminate and radically cure an obdurate cancer as electricity. He condemns the use of the knife as inhuman and inefficient. He uses the galvano-electrolytic batteries. The current shot into the heart of the cancer penetrates to every root and fiber connected with it. By this method all cancerous matter is utterly destroyed, forced out in the form of gases, leaving only a shriveled pulp. This, upon being removed, discloses a healthy sore, which heals rapidly.

A Selenium Actinometer.

M. Morize, of Rio de Janeiro, has devised a selenium apparatus for measuring the relative intensities of the rays of the sun at different altitudes of the luminary above the horizon. It consists of a selenium cylinder prepared according to the plan of Professor Graham Bell, 38 discs of copper being isolated from each other by smaller mica discs, and the edges filled in with selenium. It is insulated by glass supports inside a glass envelope from which the air has been exhausted. The vessel is elevated in a place where surface reflection does not reach it, and the axis is placed parallel to the axis of the earth so that the rays of the sun fall normally on the selenium cell and illuminate the same surface. Its position can be altered to keep up this condition from day to day. A constant current traverses the selenium and a galvanometer in circuit with it. From darkness to the most intense radiation of the sun, is the range to be observed, and a scale is graduated accordingly; Clammond's battery is that employed.

Electrical Surgery.

M. Chéroy submitted to the Academie des Sciences, France, during its séance of February 3, a new cauterizer fed by secondary batteries. A great difficulty attending the use of such an instrument, especially in localities where surgeons have not a dynamo at their disposition, lies in the charging of the accumulators. M. Chéroy proposes to effect this either by the use of a hydro-electric battery, or, where lighting gas is available, by means of a thermo-electric pile. In the first case he employs a verdigris battery, without a porous cell with zinc plates. The electromotive force of the accumulators being 2 volts, the battery is so arranged as to have 2½ volts, and to give a flow of six ampere hours. From sixteen to twenty-four hours are required for charging. In the second case the battery is composed of ninety thermo-electric elements working by gas or probably by petroleum. The constants are 4 to 5 volts, and 4 to 6 amperes.

The Electric Light in Western Cities.

In visiting the several cities in the West I have had my attention drawn to the different devices adopted for lighting the public streets. Nearly every city that makes any pretensions to public spirit has adopted the electric light in some form.

The city of Cleveland was one of the pioneers in the use of the electric light. The Brush Electric Light and Power Company made a contract with the city for the erection of four steel masts to be two hundred and fifty one feet high, from the ground to the eight arc lamps that are used on each mast or pole. These were located in the business part of the city, where the principal streets intersect each other, and give a brilliant illumination over the territory where they have been placed.

These masts are made of boiler steel plate rolled into cylinders, and riveted to each other in the most thorough manner. They are about sixteen inches in diameter at the top and thirty-six inches in diameter where they enter the ground. The construction and erection of these giant masts was no small undertaking. First the sheets were rolled and riveted into cylinders, then another cylinder was added on the underside, the inside diameter of the second cylinder being the same as the outside diameter of the first.

When securely riveted to the first, the whole was elevated and each succeeding cylinder a section was added until the total height of 251 feet was secured. The steel boiler plate thus used ranged in thickness from $\frac{5}{16}$ at the top to $\frac{3}{8}$ at the foot. As they mounted up they were held steady by wire guy ropes, which have been retained since the masts were in use.

These masts rest on heavy cast-iron plates, cast especially for the purpose, and have a bearing surface of about one hundred and fifty square feet, twelve feet below the surface of the ground.

About ten months ago Detroit adopted a similar system, using tripod towers about two hundred feet in height. These towers are made of wrought-iron tubing ranging from one-and-a-quarter to two-and-a half inches in diameter. The city located fifty-seven of these towers, but from the general complaints expressed by the citizens of that city, they do not give the satisfaction hoped for. The main trouble seems to be that the light is not powerful enough to light the streets where there are many shade trees, and to bring about anything like satisfactory results double the number of towers and lights are needed, which would so increase the expense that the citizens would prefer to return to the old gas lights.

From observations made in cities where they use electric light posts about 25 feet high, and a single light, distributed about every six hundred feet, or two short blocks, along the street, I am of the opinion that this is the best system yet adopted. Several hotels in the West have their public rooms, as well as their suites and bed-rooms, lighted by the incandescent system, at a much less cost than the use of gas.—*Mechanical News.*

Editors Electrical Review:

Knowing your desire for perfect accuracy in the statement of facts, I write to say that a mistake occurs in the account given in the *London Electrical Review* concerning Starr's invention of an incandescent lamp. It is there stated that "Mr. Peabody supplied him (Starr) with the means necessary for a journey to Europe, in order to enable him to lay his invention in a practical form before his British colleagues and the British public." The person who really furnished him with the means was Mr. P. P. Lowe, a well-known lawyer still living in Dayton, O. Though not a scientific man, Mr. Lowe saw at once the great value of Starr's invention, and advanced $4,000, the amount necessary for the before-named purpose, accepting, as recorded, a contract still in the possession of Mr. Lowe's daughter, a share of the proceeds in payment for the loan. Mr. Peabody did agree that, if Faraday gave his sanction to the invention, to advance money for its manufacture. A. B. H.

A Suggestion to Publishers of Text-Books.

Editors Electrical Review:

Have for one or more of the fly-leaves an enameled paper that can be used as a tablet for figuring or sketching, so the pencil marks can be easily erased with rubber. I have one such (the paper rather thin, however, and there by accident probably), and I find it very convenient. In studying, a pencil is frequently at hand, but not always paper for making notes, etc. P. D. R.

At a fire a few days ago, in the City of Chicago, the Grannis block was completely destroyed. The Sperry Electric Light Company had a plant there, which suffered the fiery fate of the rest of the building. Some one—of course, not any one interested in the manufacture of gas—intimated that in the electric light wires could be found the origin of the blaze, and this went out in the press with the usual comment and suggestion. An investigation proved that the fire had its origin on the fifth floor, and not an electric light wire extended above the basement! The city inspector of electric light wires, Mr. C. C. Haskins, decides that, under the circumstances, some other cause will have to be discovered before a satisfactory conclusion as to the fire's origin can be reached. We think so, too.

—— In Chicago the electric light interests have inaugurated a plan that is deserving of general adoption. A permanent organization has been formed, with constitution and by-laws, stating the object to be the "benefit and protection of the electric lighting interests." The meetings are to be held monthly, and much good will, no doubt, result.

—— Dr. Berkholz, medical director of the Commandanten-Strasse Baths, Berlin, has successfully treated, by electric current, both rheumatism and various cerebral and nervous affections. He employs both induced and galvanic currents, the intensity of which is regulated to suit individual cases, the electric bath lasting a quarter of an hour. If the action is to be general, one of the electrodes is put in connection with the bottom of the bath, while the other is held by the patient's hands; but if it is to be local, the part affected is placed between two large copper electrodes.

Why is it that when there is a depression in business, and the times are comparatively severe, that the official representatives of the people are more than ever zealous and determined in their efforts to tax prominent business interests. Did it ever occur to the honorable legislators that companies which depend on the people for their patronage are the first to feel the effects of the hard times? Yet, as if determined to double the load and drive away all tendency that capital may have in sustaining and developing such interests as the electric light and telephone and telegraph, the first and most vigorous efforts of all legislatures are to devise some means to levy a tax on these interests, which are, as a rule, the first to suffer financial loss from depression.

ELECTRIC LIGHT NEWS

—— The Western Electric Company have received an order from London for a 22-light plant.

—— Can any of our readers give us any information concerning the status of the Baxter Electric Light Company?

—— Several of the new steel cruisers are being equipped with the Weston and Brush Swan incandescent lamps and Armington and Sims' engines.

—— Incandescent scarf pins are now in demand. The young wooer ornamented with one of these can easily lead the conversation up to "sparking," and his scheme never be once suspected.

—— During the electric light convention the Western Electric Company placed a dozen of their handsome arc lights in the main corridor of the Grand Pacific Hotel, creating a beautiful effect.

—— L. G. Woolley, of Grand Rapids, Mich., is reported to have perfected a battery and electric lamp of eight-candle power, which runs four hours. This is a good field to work in.

—— The Fuller Electric Light Company, Ohio, of which Mr. John R. Fletcher is general manager, has been given a three-years' contract for lighting the city. The city fathers of Dayton appreciate a good thing.

—— Messrs. Armington and Sims have received orders for engines to be used on all the Government steamers used by the Mississippi River Commission, on which the Edison and Thomson-Houston systems are being installed.

—— It is said that the new electric light company which is now being organized in New York, with a capital stock of $3,000,000, will absorb the American Electric and Illuminating Company, the Boulton Carbon Company and other interests in connection with electric lighting.

—— The Parker-Russell Mining and Manufacturing Company, of St. Louis, expect to have their new plant, with a capacity of five million carbons per annum, ready for work by April 1st. Their electric light pencil is known as the "Sunlight."

—— The United States Electric Light Company are putting in 220 incandescent lights in the Palmer House barber shop, Chicago. That is probably as near as we will ever come to having electricity take the place of chloroform with artists of the razor.

—— The Excelsior Electric Light Company, of New York, are placing a dynamo in the Argentine Smelting Works, to be used for finding silver by electrolysis. These works are located four miles west of Kansas City, and, we believe, are the first to put the dynamo to this use.

—— Mr. Theo. P. Bailey, with the Thomson-Houston Company, Chicago, has just completed arrangements with a strong local company for a plant at Terre Haute, Ind. Fifty lights have been contracted for. Mr. Ballou, with the same company, has also secured a contract for a fifty-light plant at Oshkosh, Wis.

—— Mr. E. B. Palmer, Secretary and Treasurer of the Sperry Electric Light Company, Chicago, reports business exceedingly good, two months' work showing up ahead of the present. They have the contract for 50 arc lights for the new Board of Trade building in their city, which is to be finished by May 1st.

—— A company has been formed in Paris for running a new line of boats on the Seine. Each of the 32 steamers composing the fleet will be lighted by Bosquet with twenty-two 16-candle incandescent lamps, supplied by a Gramme dynamo modified by M. Raffard, which, at 950 a minute, gives out an E.M.F. of 110 volts at 18 amperes.

Business Notice.

A. L. Bogart, Electrician, No. 22 Union Square New York, manufacturer and sole owner of Letters Patent and licenses controlling every variety of electric gas lighting apparatus for churches, theaters, public and private buildings, having by long experience and persistent effort acquired the best known system of constructing as well as of applying the varied apparatus used in the lighting of gas jets by electricity, has secured for them an admission of superiority, and an almost unlimited demand, resulting in the employment of improved machinery, tools and skilled workmen, and the production of a vast variety of apparatus, both faultlessly and economically made.

The trade procure almost every article required in the electric line from Mr. Bogart at less than the same would cost to manufacture in limited quantities. Prices are based on a living profit only, above actual cost. Royalties on patent rights are not considered.

The attention of the trade and of consumers is respectfully called to the subjoined list of patents issued or assigned to or controlled exclusively by A. L. Bogart. The validity of the patents marked thus (*) has been confirmed by decrees of Judge Addison Brown, of the U. S. Circuit Court for the Southern District of New York, December 25, 1884:

LIST OF THE BOGART PATENTS.

Multiple Gas-Lighting Apparatus.

No. 93,563 Aug. 10, 1869, H. J Smith, Frictional Machine.

No. 119,561 Oct. 3, 1871, A. L. Bogart, Glass or Porcelain Insulation in a Gas-Burner.

No. 194,328 Aug. 21, 1877, A. L. Bogart, Lava as an Insulator in a Burner.

No. 199,676 Jan. 29, 1878, A. Wright, Wire Electrode Carried by a Lava Tip.

Single-Hand Gas-Lighting Apparatus.

*No. 116,054 June 20, 1871, Heyl & Diehl, Combination of Cock, Movable and Fixed Electrodes in a Gas-Burner.

*No. 146,953 Jan. 27, 1874, A. T. Smith, Hand-Lighter operated by Stop-Cock.

No. 152,427 June 23, 1874, A. T. Smith, Vibrator Burner.

No. 177,459 May 6, 1876, A. L. Bogart, Cock Burner and Method of Insulation.

*No. 180,832 August 8, 1876, A. L. Bogart, Use of Pendant, Wire or Chain to operate spark-producing Electrode in a Hand Burner.

No. 180,833 August 8, 1876, A. L. Bogart, Cork-Burner.

No. 202,694 April 23, 1878, A. L. Bogart, Fixed Arm Burner.

No. 203,406 May 7, 1878, A. L. Bogart, Insulation of Fixed Electrode by Collar on Lava Tip.

No. 206,272 July 23, 1878, A. T. Smith, Pivoted Bar Electrode.

No. 209,016 Oct. 15, 1878, A. L. Bogart, Automatic Burner.

*No. 225,971 March 2, 1880, H. F. Packard, the Original Ratchet Pendant Burner.

No. 259,267 June 6, 1882, A. L. Bogart, Automatic Burner.

No. 279,634 June 19, 1883, A. L. Bogart, Automatic Circuit Cut-off.

No. 282,043 July 31, 1883, A. L. Bogart, Candle Pendant Burner.

No. 290,732 Dec. 25, 1883, A. L. Bogart, Automatic Circuit Cut-off.

No. 292,732 Feb. 5, 1884, A. L. Bogart, Automatic Circuit Cut-off.

No. 292,786 Feb 5, 1884, A. L. Bogart, Automatic Gas-Lighting Attachment for Burglar Alarms.

No. 306,128 Oct. 4 1884, A. L. Bogart, Cock Burner.

*No. 7,249 Aug. 1, 1876, A. T. Smith, Reissue of No. 146,953.

Also for the States of New York, New Jersey and Pennsylvania.

No. 121,301 Nov. 28, 1871, J. P. Tirrell, Automatic Burner.

No. 121,302 Nov. 28, 1871, J. P. Tirrell, Automatic Burner.

No. 230,567 July 27, 1880, G. F. Pinkham, Hand-Lighter.

No. 230,589 July 27, 1880, J. P. Tirrell, Automatic Burner.

*No. 230,590 July 27, 1880, J. P. Tirrell, Automatic Burner.

All parties are hereby notified that infringers will be prosecuted for manufacturing, selling, or using any gas-lighting apparatus covered by the foregoing list of patents, not obtained of A. L. Bogart or of his authorized agents.

March 1, 1885. A. L. BOGART.

OKONITE

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ELECTRICAL PATENTS

INDEX OF INVENTIONS FOR WHICH LETTERS PATENT OF THE UNITED STATES WERE GRANTED IN THE WEEK ENDING MARCH 3, 1885.

313,053 Electric Circuit; Henry F. Campbell, Concord, N. H.

313,058 Electrolytic Liquid for Storage Batteries; W. E. Case, Auburn, N. Y.

313,091 Automatic Cut-Out for Electric Circuits; John B. May, Watertown, Wis.

313,117 Apparatus for Charging and Discharging Secondary Batteries; Wm. Stanley, Jr., Englewood, N. J.

313,147 Municipal Telegraph; John C. Wilson, Boston, Mass., assignor to the Municipal Signal Company, Portsmouth, N. H.

313,150 Electric Fuse Shell; Edmund L. Zalinski, U. S. Army.

313,175 Printing Telegraph; Gilbert A. Cassagnes, Paris, France.

313,176 Printing Telegraph; Gilbert A. Cassagnes, Paris, France.

313,215 Thermo Electric Battery; Daniel Lautensack, Vienna, Austria-Hungary, assignor of two thirds to Adolph Kohn and Oskar Laske, both of same place.

313,247 Regulator for Electro-Dynamic Motors; Frank J. Sprague, New York, N. Y.

313,297 Automatic Lamp Lighter and Extinguisher; B. B. Bunnell, Branford, Conn.

313,298 Multiplex Telegraph; Charles G. Burke, Richmond Hill, N. Y.

313,305 Electric Cable; William H. Eckert, John A. Seely and Edmund A. Eckert, Cincinnati, Ohio, assignor to the American Bell Telephone Company, Boston, Mass.

313,313 Automatic Electrical Cut-off; Edward Gannaway, Nashville, Tenn.,

313,377 Clamp for Binding Wires to Insulators; Wm. H. Sawyer, Providence, R. I.

313,380 Electrical Conductor, Sydney F. Shelbourne, New York, N. Y.

313,404 Electric Indicator for Pool Tables; Elias Curtis, Kansas City, Mo.

313,409 Combined Telephone Receiver and Circuit Breaker; William H. Eckert, John A. Seely and Edward A. Eckert, Cincinnati, Ohio, assignors to the American Bell Telephone Company, of Boston, Mass.

313,410 Hanger for Electric Cables; William H. Eckert, John A. Seely and Edward A. Eckert, Cincinnati, Ohio, assignor to the American Bell Telephone Company, Boston, Mass.

313,436 Electric Arc Lamp; C. Odilon Mailloux, New York, N. Y., assignor to the Thomson-Houston Electric Company, Boston, Mass.

313,437 Electric Arc Lamp; C. Odilon Mailloux, New York, N. Y., assignor to the Thomson-Houston Electric Company, Boston, Mass.

313,462 Telegraphic Apparatus; Charles W. Williams, Cave City, Ky., Edward B. Ives, New York, N. Y., and George S. Barnum, Atlanta, Ga.

A printed copy of the specification and drawing of any patent to the annexed list, also of any patent issued since 1865, will be furnished by any of the patent solicitors whose advertisements appear in this journal. In ordering please state the number and date of the patent desired.

If an invention has not been patented in the United States for more than one year, it may still be patented in Canada. Cost for Canadian patent, $40.00. Various other Foreign patents may also be obtained.

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